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Fig. 2



Fig. 3

(See Article on Page 14)

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Wildlife Damage to Life, Property and Crops

Wildlife straying into areas of human activity damages cultivated crops—the main culprits being elephants, deer, antelopes, pigs, slothbear and birds. Man invades the habitat of Wildlife in search of cultivable areas. Who is the real culprit—man or Wildlife? The entire habitat of Wildlife or all Wildlife cannot be destroyed without fatal damage to human life. Specific areas have been set apart as Wildlife habitat. Wildlife recognises no such boundaries and this results in damage to human life, property and crop.

The damage resulting from such intrusion includes damage to cultivated crops by elephants, deer (various species), pigs, slothbear and killing and sometimes eating of human being by tigers, leopards, slothbear and mauling and killing to eat of domestic animals by tigers and leopards.

For quite some time political agitation and pressure is building up against Wildlife and a solutions has to be found. The palliatives are compensation for loss of life, property and crops damaged, though this is no solution.

Forest Departments of many States, pay considerable sums in compensation for damage by elephants e.g. Mysore Circle paid Rs. 161,341 on 380 claims during 1981-82, Kodagu Circle gave Rs. 5 lacks a year for damage by Wildlife mainly elephants. Killing of man and livestock by tigers is compensated for by Forest Departments in many States.

Elephant, a very useful animal when domesticated, is known as ship of the Jungle and still used as a means of transport in water logged areas, leads processions and is worshipped. Domestic elephants are also responsible for loss of human life and no one can guess whether domestic or wild elephants are responsible for more loss of life.

Wild elephants living in the nearby sanctuaries and parks are responsible for seasonal damage to cultivated crops—stored grain and human habitation.

Elephants damage shade, trees, young tea bushes, planting areas and rubber plantations. In South India Coffee a Commercial crop—is also subject to elephant damage in Nilgiris. Man killing is a very serious aspect of elephant damage.

Various methods are used for limiting the damage. Methods to prevent the damage include driving them away when noticed from watch towers. They are driven off with fire sticks, crackers, drums, spears, bows and arrows. Elephants often ignore these methods and results are men crippled or killed.

Anti-predation squads using jeeps flash-lights crackers and shotguns and tear gas guns meet with little success.

Koonki chase resulting in population reduction by capture has no significant success.

Trenching boundaries is expensive and temporary because of breaking down of trench sides by elephants and deer climbing out of trenches and siltation and erosion by flood waters during monsoon.

Barbed wire fences have been tried against elephants in few cases but often the stone posts are broken down. 200 Volt Electric barbed wire fences are dangerous because of possibility of electrocution. Their use is highly dangerous to human and animal life.

The pulsating current electric fencing being tried at many places must be clearly distinguished from fences connected with 220V Mains.

Recorded growl of a tiger and spraying of tiger urine has also been tried as repellants without much success. The method is costly and sufficient quantity of tiger urine is difficult to get.

Favourite crops inside forest areas may lure elephants and deer from crops outside the forest. Attractive species like bamboo may keep elephants in forests and prevent raiding. A cheap and effective solution has still to be found.

New Experiment

Six Rhinos—three males and three females have been flown from Kaziranga (Assam) to Dudwa National Park (Lakhimpur Kheri—U.P.) to give the species a New home. We hope the experiment will succeed.

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Final location of the Wildlife Institute of India has been decided. Dehra Dun is fortunate to have been selected. It will be a centre for wildlife activities not only for India but for South East Asia also.

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Sheikh's Swoop to Kill

Royal Princes of Saudi Arabia and the Oil Sheikhs of the Gulf armed with killer falcons and radar are hunting down the houbara bustard—a rare migratory bird which has been declared an endangered species by International Conservation Groups. An appeal by Prince Philip has failed to halt the killing in Pakistan. The Princes bring in hundreds of jeeps and aircraft, servants, military secretaries, retainers and special transformers for air-conditioning tents. Lavish desert Palaces have been built in Pakistan deserts.

Eco-Development as A Solution for India's Environmental Problems

BY

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(A) The Genesis of India's Environmental Problems

1. Endowed by a bounteous Nature with a wealth and variety of natural resources, India has always been the cynosure of all eyes in the world community. It has attracted hordes of foreign invaders down the ages, some of whom like the British, even conquered the country, ruled over it for a couple of centuries and fully exploited its raw material resources for their own benefit.

2. The banks of the country's major rivers passing through fertile plains were the first areas to be colonized. Subsequently, with the steady growth of population and extension of agriculture, the luxuriant tropical forests around human habitations were cleared and brought under cultivation for increasing food production, thereby steadily increasing the area under agriculture at the cost of the forest area which gradually receded into the hills. The British also took full advantage of India's rich forest resources to bolster their war effort during the two World Wars of the current century in which they were involved by commandeering huge quantities of timber required for defence purposes. India's forests received another severe mauling after the attainment of independence from British domination in 1947 as a result of the merger of princely States and the abolition of jagirs and private forests. The rapid and ruthless decimation of private forests all over the country as also of the rich wildlife they harboured, during the fifties and sixties was a calamity of the first magnitude and the Central and State Governments shall never be forgiven by posterity for their shameful failure to take timely and effective action to halt this madness which caused colossal and irreparable damage to the country's already depleted flora and fauna.

3. In the wake of this holocaust followed another ecological disaster resulting from a host of major hydel and irrigation projects, mostly located in the few remaining good forest areas, and the mushrooming industries which came up rapidly all over the country with the launching of successive five year development plans which ushered in an unprecedented industrial boom. While the irrigation projects made further inroads into forest areas and wildlife habitats through submergence as well as allotment of lands for the rehabilitation of oustees, the industries stepped up the consumption of natural raw material resources at one end and

created serious water and air pollution hazards at the other through the discharge of industrial effluents into rivers and obnoxious and often carcinogenous gases into the atmosphere. Water and air were also increasingly fouled by the discharge of raw sewage from the overpopulated urban conglomerations, which took a heavy toll of aquatic and marine life, and the incessant discharge from the belching exhausts of the numerous trucks, buses, automobiles and two wheelers rolling off the indigenous assembly lines. Add to these the ravages of the mining industry blasting and digging into the very bowels of the earth, the indiscriminate use of synthetic fertilizers and agricultural weedicides and pesticides, and the decimation of the protective vegetal soil cover by millions of semi-starved scrub cattle enjoying free grazing all over the countryside and you have before you the complete horrifying picture of the terrible ecological disaster towards which we are precipitately heading for.

4. The benign influence of forests and the key role they play in a predominantly tropical monsoon type of climate in a country such as ours, where agriculture is the main occupation of the people, need to be properly understood and appreciated by the average layman. The fact that forests provide us with timber, fuel, industrial raw materials, fodder, and host of minor forest and wildlife products is only too well known to need further elaboration. But not many people realise that forests equalise the climate; increase rainfall; harness solar energy; check run off; protect the valuable top soil which would otherwise be carried away by rain water into the sea or be blown away by wind; immobilize the spread of deserts; help to absorb rain water into the soil for recharging ground water aquifers which continue to feed our springs, rivers and wells during the dry summer season; prevent devastating floods and drought which are the cause of so much human misery; purify the atmosphere by absorbing carbon dioxide which all living beings exhale and replenish the supply of life-giving oxygen without which we cannot survive; provide recreation by enhancing nature's aesthetic value; offer sustenance and livelihood to our forest-dwelling tribals; and serve as a habitat for wildlife. Indiscriminate destruction of forests, particularly on vulnerable hill slopes, triggers off a chain reaction giving rise to serious ecological imbalances which ultimately recoil on man himself by unleashing devastating floods or droughts which take an immense toll of life and property, by decreasing agricultural production, by severely curtailing the life span of costly hydel and irrigation projects through siltation and the like.

5. The annual losses caused on this account computed in monetary terms would run into an astronomical figure. For example, erosion results in an annual loss of around 6000 million tonnes of fertile top soil, an inch thick layer of which takes anywhere between 500 to 1000 years to build up by the natural process of rock disintegration, and which has been estimated to contain nutrients of the order of over 5 million tonnes of NPK alone which it would cost well over Rs. 1000 crores to replace at current prices. Similarly, floods, which are the direct result of the siltation of river beds, take an average annual toll of around

Rs. 300 crores by way of damage to crops, cattle, habitations and communications, apart from the colossal human suffering and misery which can never be quantified in monetary terms. Large areas of what should be highly productive lands in the command of irrigation projects often go out of production on account of water logging, salinity or alkalinity caused by canal seepage, inadequate drainage, excessive irrigation or obstruction to natural drainage by railways, roadways, canals and embankments without provision for adequate cross drainage, and the value of productive lands lost in this manner is estimated to be well over Rs. 10,000 crores. To all these losses must be added those which are being suffered as a result of our failure to put to productive use vast areas of denuded and degraded non-agricultural wastelands which exist across the length and breadth of this vast country.

6. According to official statistics, out of our country's total land area of 304 million ha, a total of 182 million ha (i.e. about 60%) as detailed below are in need of urgent attention to save them from further degradation and put them to productive use:

Area suffering from water erosion	—	90 million ha
Area suffering from wind erosion	—	50 million ha
Area affected by flooding	—	20 million ha
Area affected by waterlogging, salinity and alkalinity	—	22 million ha
Total	—	182 million ha

The category-wise break-up of the country's land area is as under:—

Agriculture	—	138 million ha
Forests	—	65 million ha
Miscellaneous tree crops	—	4 million ha
Permanent pastures	—	13 million ha
Fallows	—	26 million ha
Culturable wastes	—	17 million ha
Barren and unculturable	—	24 million ha
Non-agricultural uses	—	17 million ha
Total		304 million ha

Out of the area of 65 million ha classified as "forests", hardly 30 million ha have adequate tree cover, the remainder being more or less devoid of any appreciable vegetal cover and hardly worth calling a forest. These 35 million ha, together with another 60 million ha from the other categories, represent more or less barren and unproductive areas which not only do not contribute anything to the national economy but are, on the contrary, the main

source of serious soil erosion and its attendant evils. What a tremendous difference it would make to our economy if all these 95 million ha could be revegetated and restored to their original level of productivity within a reasonable time frame so that not only would further soil erosion be arrested, but the sun's energy harnessed once again in nature's own way over nearly a third of our total land area. (Note:—The statistics quoted above have been taken from the excellent paper on "Managing India's Land and Water Resources" by Shri B.B. Vohra, Secretary to the Government of India, Department of Petroleum, published in August, 1978).

(B) Solution to The Problem

7. We in India are no doubt eager to join the ranks of the developed nations of the world and, thanks to our rapid advances in the fields of science and technology during the past few decades, we are well on our way to achieving this cherished goal. However, the one single factor which has seriously impeded our march and prevented the benefits of development from reaching the masses is the explosive rate of increase in our population which now threatens to double itself every 25 years. Satisfying the insatiable demands of our rapidly increasing numbers neutralizes the increased production of goods and services and prevents us from surging ahead in the race for development. This factor is basically the root cause of almost all our environmental problems and an effective check on population increase is the sine qua non of any strategy that we might evolve as a solution for our environmental problems.

8. Today, as we stand at the crossroads of human history, it is essential that we pause and take careful stock of the grave crisis in the form of all round environmental degradation which we have brought upon ourselves through our selfish exploitation of our natural resources and thoughtless application of science and technology, thereby jeopardizing the very survival not only of ourselves but of all living creatures who share this earth with us. The economics of a prosperous welfare society which we are trying to build up must necessarily undergo a fundamental reorientation so as to bring them in conformity with the basic concepts of nature conservation if we hope to live at peace with ourselves and in harmony with our environment. "Development Without Destruction" must become the new Strategy for our future planning. In other words, the solution of our environmental problems lies in "ECO-DEVELOPMENT".

9. What precisely do we mean by "Eco-Development"? Although this term has been vaguely bandied about of late, no attempt appears to have been made to define it. It may therefore mean different things to different people. To avoid any confusion or ambiguity, I propose to define it as under:—

"Eco-development" of any region may be defined as its integrated development in conformity with the recognized concept and principles of environmental conservation with the object of ensuring that—

- (i) A proper balance between the components of all natural ecosystems is maintained so that existing life forms are not needlessly endangered.
- (ii) The natural flora and fauna of the area is preserved and restored where it has been depleted.
- (iii) Damage from all forms of pollution and from any other factors capable of causing environmental degradation is eliminated or at least minimized.
- (iv) All land is put to optimum use so that it produces the most and deteriorates the least.
- (v) There is a general improvement in the quality of life for the people residing in the area.

10. In the light of its above concept and definition, an eco-development project could possibly involve activities of the following nature:—

(a) **Forest Conservation and Development Activities :**

- (i) Control of cattle grazing through effective closure by fencing, appointment of watchman, penning of cattle with the co-operation of local people, etc.
- (ii) Carrying out soil and moisture conservation works, such as contour trenching (gradonis), check damming, gully plugging, construction of ring bunds, soil mulching, making shallow saucer-shaped pits (in arid areas), etc.
- (iii) Establishment of nurseries near sources of perennial water supply for raising adequate planting stock of the desired species (preferably indigenous).
- (iv) Large scale afforestation/revegetation of barren/degraded areas, adopting specialized sowing/planting techniques, such as aerial seeding where large or inaccessible areas are to be covered within a limited time schedule or where adequate local labour is not available when required. The problem is so gigantic that the conventional afforestation techniques involving manual labour adopted by the Forest Departments with their limited staff would appear to be hopelessly inadequate. Afforestation through aerial seeding on an experimental scale has already been undertaken in Arunachal Pradesh, Madhya Pradesh, Rajasthan and Maharashtra very recently.

- (v) Creation of shelterbelts and windbreaks along roadsides, canal banks, railway tracks, individual field boundaries, etc.
- (vi) Afforestation along coastal strips, desert border and sand dunes, catchment areas of rivers, lakes and reservoirs, mangrove afforestation in tidal swamps, reboisement of areas under quarrying and mining, etc.
- (vii) Raising urban forests for public recreation.
- (viii) Setting up of arboreta and botanical gardens.

(b) Wildlife Conservation Activities:

- (i) Establishment of Sanctuaries, National Parks and biosphere reserves.
- (ii) Breeding and propagation of endangered species.
- (iii) Establishment of breeding farms for game animals and birds as a commercial activity by Government and private agencies. These could also be utilized for restocking depleted areas.
- (iv) Establishment of zoological parks.
- (v) Improving food, water and shelter facilities for wildlife, providing nest boxes for nesting of birds, salt licks, etc.

(c) Rural Development Activities:

(1) Community Forestry:

Creation of village woodlots so as to make villagers self sufficient in meeting their requirements of small timber, bamboos, fuel and fodder, thereby relieving the tremendous pressure on Government forests which suffer heavy damage on this account.

Strip planting along roadsides, canal banks and railway tracks.

Helping farmers to raise trees on their field boundaries to act as wind-breaks.

Encouraging agriculturists to take to commercial tree farming, particularly on marginal lands.

Establishment of Kissan and school nurseries. Pasture improvement in village commons (gauchars). Promotion of fuel-saving devices in villages, viz. smokeless 'chulas' and improved crematoria, for meeting the acute shortage of fuelwood in rural areas.

Gujarat State has already given a pioneering lead to the rest of the country in the field of community forestry by launching a gigantic programme of the above activities at a cost of Rs. 64 crores with financial assistance from the World Bank. The results achieved have been spectacular and worthy of emulation by other States.

(2) **Miscellaneous Activities:**

- (i) Protective and bioaesthetic tree planting.
- (ii) Animal husbandry—improvement of cattle breeds through castration of scrub cattle and artificial insemination, stoppage of free forest grazing and encouragement of stall feeding.
- (iii) Dairy co-operatives.
- (iv) Poultry farming.
- (v) Apiculture.
- (vi) Sericulture (where climatic factors are favourable).
- (vii) Pisciculture—fish, prawn and oyster culture.
- (viii) Alternative sources of energy—biogas, solar energy, windmills (where strong winds prevail).
- (ix) Subsidized cottage industries based on various forest, wildlife and marine products, (e.g. bamboo matches, toys, baskets and mats, katha, oil seeds, tans and dyestuffs, aromatic oils, lac, bidi leaves, agarbattis, medicinal plants and products, peacock feathers, fillets and protein tablets from trash fish, fish kheema, tooth and talcum powders, shell grit and cleansing powder from sea shells, cultured pearls, edible sea algae, etc.). This list is illustrative and not exhaustive.
- (x) Encouraging the development of tribal art, culture and handicrafts.

(d) **Conservation Education Programme:**

An intensive programme of nature education for creating conservation awareness among the public in general and the younger generation in particular would go a long way in making them appreciate the beauties and marvels of nature and the need for conserving forests and wildlife, the interrelationships between different species of flora and fauna, the harmful effects of various forms of pollution, etc. This would help to build up a favourable public opinion in support of nature conservation which is generally lacking in our country at present. There is tremendous scope for fruitful collaboration between the State Forest

Departments and conservation organisations like the WWF for propagating the message of conservation throughout the country. Here again, the Gujarat Forest Department has done commendable work for the last five years by organizing subsidized nature education camps for thousands of school children every year at selected places like Hingolghadh near Rajkot, Pirotan Island in the Gulf of Kutch, the famous Gir Lion Sanctuary, and at Dabka and Jambughoda around Baroda in collaboration with the local branches of WWF. The children's spontaneous response to this unique and thrilling exposure to the outdoors has to be seen to be believed, and a majority of them come back for more. Starting with a modest grant of Rs. 35,000/- in the initial year, the Government of Gujarat now invests about Rs. 3 lakhs for these outdoor camps which have become a very popular annual feature. WWF also contributes to this programme by providing camping equipment and volunteers to act as guides.

(c) **Involvement of Industrial Houses:**

11. Industries which are dependent on natural resources for their raw material more often than not cause environmental damage. A typical example of such an industry is the Digvijay Cement Company at Sikka in Jamnagar District which has caused irreparable damage to the unique marine ecosystem in the Gulf of Kutch with its characteristic association of live coral formations and mangrove vegetation which has suffered heavily as a result of the dredging for calcareous sand as raw material for cement manufacture for several decades. Even industries which do not depend on natural resources for their raw material invariably damage the environment either by polluting the atmosphere with obnoxious fumes ceaselessly belching forth from their chimneys or by callously discharging their toxic effluents into the nearest river the detriment of the aquatic life and the users of the river water downstream. It would therefore be in the fitness of things if all industries were to earmark some portion of their profits for eco-development, thereby making amends for the environmental damage resulting from their operations and discharging their moral obligations to society by improving the general quality of life in their area of operation. Such a step would incidentally, also prove mutually beneficial since such investment on rural development activities would entitle them to tax relief under the existing regulations. Thus, every eco-development project must ideally involve not only the Government agencies and the local people but also the industrial units operating in the region which constitute an important pervasive force in the area capable of exerting a strong catalytic influence by diverting a sizeable part of their earnings to finance a welfare activity which would, in the long run, build up their own image and ensure their own future survival and prosperity. A modest beginning in this new direction has already been made in Gujarat and Maharashtra by the enlightened house of Tatas which has blazed many a pioneering trail in matters of industrial reforms and innovations. For example, M/s Tata Chemicals located at Mithapur in

Jamnagar district of Gujarat have shown keen interest in nature conservation and made systematic efforts for the proper bioaesthetic planning of the Mithapur township through large scale tree planting and providing plenty of open spaces for public recreation. In such a desolate windswept area, their successful efforts at raising a dense stand of graceful *Casuarina* trees along the coastal sand dunes west of Mithapur for checking wind-blown sand are highly commendable. They have also set up a separate Society for Rural Development which has been entrusted with the infrastructural tasks of providing rural link roads, primary education, supply of drinking water, tree planting and afforestation, etc. Even its extensive salt pans in the otherwise inhospitable tract of the Okha Runn have been transformed into a veritable haven for aquatic and shore birds by taking up shrimp and fish culture in the low concentration condensers which consequently attract large flocks of pelicans, storks, spoonbills and even flamingoes. They have also made a sizeable donation of Rs. 10 lakhs to WWF—India, Western Region, for financing conservation projects. I am currently involved in the formulation of an eco-development project for the entire Okha-mandal taluka (in which Mithapur falls) in collaboration with WWF, which will hopefully serve as a model for similar projects elsewhere. Similarly, in Maharashtra, M/s Tata Electric Companies are currently involved in a pilot project of afforestation through aerial seeding of about 5000 ha of denuded forest area in the catchment of Shirawta and other lakes near Lonavala which generate electric power for Bombay.

12. Hopefully, the pioneering lead given by Tatas would, in due course, be emulated by other progressive and enlightened industrial houses whose active involvement in the eco-development process would provide a vital breakthrough in the field of environmental conservation in a developing country like India.

13. I am quite confident that this august body of eminent conservationists, who have gathered here on the auspicious occasion of the centenary of the Bombay Natural History Society, will deliberate at length on this new facet of this country's development process and lend their wholehearted support to the innovative concept of eco-development which I have outlined above. This is positively our only hope of averting the ecological disaster which our present mode and trend of technological development otherwise have in store for us.

Example Management Situations for Indian Blackbuck Antelope (*Antelope cervicapra*)

By

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AND SHARON E. DOUGHERTY****

One of the objectives of the joint United States-Indian Blackbuck project active from January to April 1980 was to gain impressions of the practice and potential of conservation and management for Indian blackbuck antelope (*Antelope cervicapra*) in a selection of Indian areas. The map in figure 1 names and locates the five blackbuck populations visited during the study. Although field work concentrated on two of India's largest native populations—at Velavadar in Gujrat State and at Point Calimere in Tamil Nadu,—certain aspects apply in varying degrees for other populations as well. Therefore, the project team's analysis for these two large populations is presented here so that all persons in charge of blackbuck can consider whether any of the ideas would be helpful in their own situations.

General Impressions

The supervisory staffs at both Velavadar Blackbuck National Park and Point Calimere Wild Life Sanctuary seem sincerely interested in their areas and committed to the welfare of their wild charges. With such a positive foundation to work from, continued efforts for informed management ought to produce continued improvement. Parks run to sustain wildlife species in their natural environment offer more to both their inhabitants and their visitors.

Although each area's conditions are unique, several topics are relevant for both. A few of these will be treated first followed by a discussion for each of the two major sites individually.

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General Training

The Forest Department's orientation toward plant production gives their officers potential for a good perspective when managing for particular wildlife species. To manage for wildlife in natural areas, one manages the environment. Thus, an intimate knowledge of plant processes is an essential complement to the special wildlife training necessary. However, success assumes at least two other ingredients. First, the manager must perceive the goal clearly. If the goal is maximum sustained yield of blackbuck antelope on natural rangeland, then cash return from other possible uses of the land—livestock grazing, firewood production, fertilizer gathering, etc.—must remain secondary considerations except as compatible with, or necessary for, attaining the major objective. At the same time, alternative uses and revenue sources consistent with the major objective should be pursued even if they deal with facets of such non-forestry aspects as tourism. Second, managers should have expertise in those environmental aspects relevant for their tasks. Even after taking wildlife training, an expert in silviculture may have difficulty managing for an open plains species like blackbuck. Blackbuck managers need an understanding of grassland ecology to supplement their wildlife knowledge. Once carrying capacity is established, the site managers must be able to monitor its seasonal and yearly fluctuations, to outline practical measures for maintaining balance and to execute approved measures. Personnel with such training are increasingly necessary for realizing the educational and economic potential of wildlife areas like Velavadar and Point Calimere which have already been established and consolidated,

Interpretive Programs

To make the visitor's stay more meaningful as well as to promote wildlife appreciation through understanding, information could be supplied at the visitors' resthouse. Possibilities include combinations of the following types: wall displays giving names and drawings of common native mammals, birds and plants visitors could watch for during the visit, a leaflet given to guests when they pay their visitors' fees supplying pictures of blackbuck and associated animals along with a description of their habits, wildlife picture postcards for sale, exhibits on subjects such as what blackbuck eat or how their ages can be determined by the eruption and wear patterns of their teeth, short talks by park personnel explaining major park features, slide shows, wildlife movies. Many of these possibilities take ingenuity and creativity more than money and yet the resulting increase in visitor pleasure can result in greater visitor revenue due to more visits. As a park's reputation grows, the distance people are willing to travel to see it also grows.

Broken Horns

One of the concerns which has to do with both visitor reaction and population health is the incidence of broken horns within the population being managed. Bucks with one or both horns broken occur in all social positions held by normal bucks. Two broken-horned bucks even held territories. All the broken-horned bucks observed were dark adult males. Although the incidence appeared high at Velavadar and insignificant at Point Calimere, analysis indicates much of this difference may be an artifact of population size.

At Velavadar where 12 broken-horned males were identified out of a population of about 2,000, only 4.4% of the dark males had one or both horns obviously broken. Nevertheless, this was a conspicuous minority; not only is the ground open and flat allowing excellent visibility but also adult males—both bachelor and territorial—congregate within sight of the visitors' lodge.

In contrast, Point Calimere has a population only a half to a quarter as large scattered in smaller groups throughout a network of openings and brush. On a day when all blackbuck that could be located without duplication were tallied by sex and age category, Point Calimere's one brokenhorned male equalled 4.3% of the dark males sighted.

In Texas, U.S.A., where blackbuck have been introduced onto ranch lands, an unhunted population of 98 had three dark male with obvious breaks (18.8% of adult males) and close examination showed another four adults had signs of old splitting near the horn tip. Such splitting is unlikely to be noticed under field conditions. In Texas, splitting and other breaks are common among males of class XIX (6 years) and older (Mungall 1978).

The problem of broken horns may well have its basis in poor nutrition. The Texas population cited was in an overgrazed pasture which could not support the whole population when stressed by severe conditions during the winter pinch period. Velavadar is also overgrazed. In 1975 the Forest Department initiated a policy of putting out hay during the summer to carry the blackbuck over until the rains bring fresh grazing. Encroachment by domestic livestock aggravates the situation. Although such violations are more common during the monsoon when the cattle owners of neighbouring Kanatalav have all their animals at home, the research team still observed at least 50 buffalo herded into the park at 0053 hr. on February 27th and not herded out again until 0651 hr. Better forage would be expected to promote growth of more resilient horn, and denser bone in the horns should reduce breakage.

Some observers have suggested reducing the number of adult males at Velavadar in hopes that fighting and consequent breakage would be reduced. However, whatever adult

males remain would still form bachelor groups within which there is always sparring and would still assume territories with their attendant border fights. Even more serious, reducing the male segment of the population would promote female survival, leading to production of even more fawns to grow up and compete for the already sparse grazing during the summer pinch period. Instead, the situation needs to be addressed with a thorough study of Velavadar's carrying capacity followed by measures to keep the numbers using the park within the determined limits. Junagadh Zoo already removes some blackbuck for exhibit and for restocking other Indian areas. When necessary, they could be allowed to trap more. Resident, native predators like the jackal could also be encouraged. This would have the added advantage of promoting a more natural balance stressing more native species within the same park. At present pariah dogs—not a native species—do a large share of hunting.

Point Calimere also needs a carrying capacity study. With the present trend toward reducing poaching, blackbuck numbers could increase beyond what can be supported. Point Calimere's long history of poaching probably contributed to its low number of males reaching the older age classes.

Mortality

Partial skulls of five blackbuck were found at Velavadar and one blackbuck died during the study. The specimens including teeth indicated that wear patterns are similar to those in Texas. Thus, the age class divisions worked out by Mungall (1978) can be applied even though similar studies on Indian material are needed to establish the appropriate age range for each wear class. Local variations in diet and soil conditions necessitate a separate study in each area for maximum reliability. If the Velavadar material had been found in the Texas "Hill Country", the assigned ages at death would have been: 3 yr, 3-4 yr, 4 yr, 5 yr, 6 yr, and 8 yr. A comprehensive sample of 92 blackbuck skulls from a winterkill in a Texas pasture are already on deposit with the Bombay Natural History Society for comparative study in working out age criteria for Indian locations. These 92 skulls were part of the sample from that winter plus other years used by Mungall to develop Texas criteria. Each skull has an assigned age class according to the Texas system.

Both Velavadar and Point Calimere occasionally have severe storms with associated mortality (Johnson 1975, Oza 1976, Rashid 1977, Dharmakumarsinhji 1978). Unfortunately, park officials failed to follow instructions to keep the skulls of Velavadar blackbuck found dead after a 1976 cyclone. However, the incident illustrates that even one such event can make available the minimum of several hundred skulls needed to yield sufficient material for calculating age-class ratios. The only further requirement is observations on a few individuals of known age to verify when key points in the series are reached. Stable natural populations in healthy condition have progressively fewer individuals in progressively older age classes,

with the oldest individuals nearing maximum longevity. The survivorship curve would give expected mortality rates for all age classes. A life table would allow comparison with other species as well as with other blackbuck populations. Among existing life tables are those for nilgai, chital and sambar in Gir Forest, Gujarat State, calculated by Berwick (1974) and for blackbuck in Texas, U.S.A., calculated By Mungall (1978). All these forms of data would be valuable tools in developing management programs to sustain the well-being of the park and in assessing the effects of changes in carrying capacity.

Velavadar Blackbuck National Park

The new plan now underway for a raised road completely within the park linking the visitors' lodge with the existing road past the photo tower with a limited extension and turn-around space on the far end should benefit the park in a number of ways. Most importantly, it will help solve a major problem, degradation of grassland due to excessive vehicle traffic. All visitor traffic should be confined to the new raised road system. As well as reducing damage to the grasslands which the blackbuck rely on for their food, this will have other advantages. Visitors will no longer be able to chase blackbuck with vehicles as presently happens, and the danger of young fawns that are lying in the open being run down accidentally will be minimized.

The Forest Department staff at Velavadar need to make sure disturbance to the concentration of *akhali* males between the lodge and the new entrance road is kept to a minimum so that this prominent segment of the species social structure—a segment which gives visitors much of their pleasure since it is so close to the lodge, so active and so striking to watch—is not forced to disband. Already the staff act quickly to stop visitors on foot from chasing the blackbuck but greater vigilance will now be needed. If the road needs repairs, hopefully the construction workers can camp somewhere besides on the edge of the *akhali* concentration area and hopefully arrangements can be made which will prevent the people from having to cross the *akhali kor* area every morning and evening to fetch water. Workers' frequent trips during construction of road as observed during the present project disrupted the *akhali kor* pattern, restricted the space frequented by the bucks and reduced the number of bucks using this area during the day. Once visitors start using the road, they must not be allowed to honk at the blackbuck or to go out on foot toward this segment of the population. The *akhali kors* can be viewed from the raised road or from the watchtower near the lodge. Visitors walking in the park to see blackbuck should concentrate their attention on the all-male groups north and east of the lodge and the female groups in the north of the park.

Concentrations of territorial blackbuck so tight as to form an "arena" like that at Velavadar are extremely rare: Only K.S. Dharmakumarsinhji (pers. comm.) recalls having

encountered similar cases elsewhere in India, notably at the Sandhida Mahadeo temple site near Sanosra about 55 km from Bhavnagar. Only the Velavadar arena has been scientifically evaluated even in a preliminary way (Mungall *et al.* 1981, Ranjitsinh 1982, Walther *et al.* 1983). This vital element in the social order of the species must not be jeopardized.

The Velavadar blackbuck population seems to have exceeded the resource base available within the park. In February, the grass was already quite short and hay from the park's *godowns* has been used routinely every summer since 1975 to feed the blackbuck. The blackbuck use the area outside the park regularly to supplement their diet with crops. Domestic animals such as buffalo, cattle, goats and sheep should be kept out of the park so that they do not further reduce the natural food supply for the blackbuck.

Planting stands of cotton and wheat within the park near the boundaries could be tried to improve the quantity of food available within the park and to reduce feeding pressure on the villagers' crops. Hiring local farmers using bullock-drawn plows for this work would minimize disturbance while creating jobs locally. Highly palatable native grasses such as *jinjuva* could also be planted. No planting should be allowed in the *akhali kor* area. An area on the opposite side of the lodge where the all-male groups presently cross on their way to feed on crops outside the park would be one good place for plantings. Other areas on the far side of the park from the lodge have to be selected to attract the large groups of females and males that travel together.

No penned blackbuck should be allowed within the park. Any research pens needed can be set up at Junagadh Zoo or Ahmedabad Zoo where proper supervision is available. Pens at Velavadar would further restrict the grazing area of the large herds, destroy grazing within the pens and create an unnatural social situation for the captive animals. Furthermore, personnel experienced in captive animal management are not available at present and displaying captive animals is not the park's function.

The park needs a map of its vegetation types, data on the frequency of occurrence of the plant species characterizing each vegetation type and a study of blackbuck food habits to see which plant species are most important for the blackbuck at what seasons and in what ratios. Then forage availability can be calculated and blackbuck carrying capacity estimated. The blackbuck population cannot be allowed to expand indefinitely. The animals will degrade their own range and increase crop use if the population is allowed to remain above carrying capacity.

Pariah dogs are presently the major blackbuck predators at Velavadar. They make regular morning and evening hunting trips. Very young animals are the easiest victims, but adult animals are also caught. Without the major natural blackbuck predator, the cheetah,

and with only light predation pressure from jackals and occasionally wolves, the pariah dogs serve a needed function at Velavadar as one check against unlimited population growth. A more natural situation more in keeping with the park's purpose of fostering native wildlife and sustaining natural communities would be created if jackals could be encouraged and pariah dogs phased out. For this, a study of both natural and feral predators is needed to identify critical factors. However, natural predation may still be insufficient to keep such a large blackbuck population within carrying capacity. Occasionally, trapping or even shooting may be necessary. Local farmers may not be willing to tolerate the incursions of wildlife forever nor is it likely that the park can withstand continued grazing by domestic stock. If it is eventually decided to fence Velavadar Blackbuck National Park, then a good estimate of carrying capacity plus adequate measures to keep the population within this limit will become even more important. In parts of Texas where only blackbuck and domestic stock are a concern, 1.5 m high square mesh wire fencing has been adequate to keep either blackbuck or domestics from crossing. This reduces fencing costs considerably compared to what is required for chital or nilgai antelope. If a dry trench is used in combination with the fencing, then it should be outside the fence rather than inside. This would keep cattle from rubbing against the fence at the same time that it would prevent blackbuck from falling into the trench and becoming trapped. A trench would be much cheaper to construct than a fence, but the trench may fill in quickly during the monsoon. An unlined trench once ran along much of the original park boundary, but it filled in during the first monsoon. It must be expected that for the first several weeks bucks used to crossing freely at particular points will thrash their horns against any new fence and sometimes succeed in breaking through (Schmied 1973). The Forest Department staff would have to persist in closing these holes so that the blackbuck will come to accept the fence.

To cut casualties when storms flood the park, the Forest Department has raised the floor level in one of the two park *godowns* and constructed a ramp to the entrance. Leaving the doors open has already proved that the blackbuck will crowd in during flood periods. Hay left over from summer feeding helps feed the animals while inside. Since more blackbuck congregate in the area than the *godown* can accommodate, an obvious extension would be to raise the ground level between the two *godowns*. The space is broad and the *godown* walls shelter it on two sides. Blackbuck would not be scared away by activity at the nearby visitors lodge since the lodge is closed during the monsoon.

Although costly, the present program battling spread of the exotic thorn tree *Prosopis juliflora* should be continued. Blackbuck relish its mast, but this extra source of protein cannot offset the loss of grassland habitat. Even though blackbuck often use shade on hot days when conveniently available, they are adapted to thrive without it. Until vigorous

promotion of *Prosopis* about a dozen years ago (Sinha pers. comm.), Velavadar was largely treeless except for a few *Acacia nilotica* (Dharmakumarsinhji pers. comm.).

Kaliyar Bhavan (Blackbuck House), Velavadar's visitors' lodge, is admirably situated (Fig. 2). While being close to the park boundary and, thus, facilitating access at the same time as minimizing disturbance within the park, the lodge still offers visitors a guaranteed view of the most spectacular segments of the blackbuck population: the territorial males and the all-male herds. A piece of equipment not already in the lodge which would add greatly to visitor enjoyment would be a large pair of binoculars of a type that could be permanently fixed to the balcony. Visitors want to feel they have been close to the animals they have driven so far to see.

An interpretive program at the lodge would help minimize aimless wandering and noise from children visiting in groups. On hot days, bucks come to water near the lodge, but only if people stay back from the tank and are reasonably quiet. Shade trees being encouraged around the lodge offer visitors places to picnic and to rest. They should not be monopolized by parked buses. All vehicles should be relegated to the designated parking areas. Shade at the main parking site would be a welcome relief for visitors whose vehicles often stand several hours in the sun. Groups waiting for their last few members before leaving would also like shade.

Point Calimere Wild Life Sanctuary

This and other short research efforts as reported in brief communications, in technical papers and as part of a new book on territoriality (Walther *et al.* 1983) plus the Ph.D. work by H.S.H. Hussainy which hopefully will become available soon in thesis form, give sanctuary officials at Point Calimere introductory scientific information supplementing their own findings on the habits of their park's most conspicuous wild mammals. The step needed next is to study the park's carrying capacity for large herbivores. Point Calimere is in the enviable position of already having available by the resthouse quarters for research scientists on long-term projects. The Forest Department needs to complete an inventory of all plant species occurring in each vegetation type at Point Calimere. Simultaneously a vegetation map showing the areas covered by each type can be produced. Next, the frequency of occurrence for the plants during each season should be determined. When followed up with a study of food habits at all seasons in blackbuck and each of the other ungulates using the sanctuary—chital, wild boar, domestic buffalo, cattle, goats, and horses,—animal units for each can be calculated. From this, sanctuary managers can see how many blackbuck can be supported when the park is also being used by given numbers of competing herbivores. Making drinking water available to the blackbuck on the Temple Lands—major use area for the blackbuck—during the summer pinch period may help immediately to increase blackbuck carrying capa-

city by allowing increased use of dry, salty forage. The park is fortunate in having an active population of resident native predators, the jackals, to assist in maintaining a natural balance. These predators should not be disturbed within sanctuary boundaries.

If raised grazing fees succeed in reducing the numbers of domestic grazers—the numbers actually using the park even when this may vary from the number of permits issued—then more blackbuck can be supported. One way to ease both competition and local resentment over losing grazing rights in the sanctuary would be to find alternative pasture for the domestic stock. In all these activities, both vegetation assessment and grazing adjustment, the Temple Lands need to be fully included because they form the prime blackbuck habitat at Point Calimere. Even if they are not officially owned by the government, there need to be binding agreements providing for their continuing management as a wildlife sanctuary area in combination with the Kodiakkadu Reserved Forest.

Vegetation studies take time. To insure that there continues to be a diversified wildlife resource to benefit from the studies, measures need to be taken to control access to the sanctuary and to limit vehicle traffic. Otherwise, poaching will remain difficult to eradicate, revenue from tourist traffic will remain low and the fragile grazing lands which supply food for the animals the visitors come to see will be degraded.

To achieve these aims, there needs to be a watcher with a radio at each end of the park to monitor vehicles, making sure that any applicable use fees have been paid. Availability of a boat would facilitate shore patrol. One vehicle road should be maintained from watcher's point at the gate on the village side of the park, through the open on the side toward the reserved forest to the lighthouse compound and from there through the open to the watcher's point at the far end of the park. There is already a road from the village end to the lighthouse but it needs to be kept passable so that cars have no excuse to make detours across the grassland. Visitor vehicles should be restricted to this road, secondary jeep tracks being reserved for park jeeps on official business. To enforce this rule as well as to enhance visitors' appreciation of their tour by providing information on the animals and their habitat and to prevent visitors from littering, a park guide should go with each vehicle.

To provide visitors a focus for their drive or walk into the park, a raised and shaded viewing platform by the lighthouse compound would be helpful (Fig. 3). Three to four metres high should be sufficient for the platform. Facing it to look out over the point toward the ocean would give the best effect. This would offer a welcome half-way stop with a chance to get a new vantage point for watching or photographing the animals and the scenery. It would also be more satisfactory for leisurely animal viewing than the lighthouse which is so much higher. A viewing area accessible to the public could also be included in the watchtower built to house the watcher overseeing the far end of the park. However,

the main consideration here would be facilitation of the watcher's guard duties; opportunities for wildlife viewing are rarely as good here as at the lighthouse.

In order to realize hopes for the expanded tourist traffic that the sanctuary's striking mammal complement and abundant migratory birds deserve, there is an additional problem which must be addressed: sanitation. Even though Point Calimere is blessed with an efficient local clinic, the resthouse needs fresh water, clean towels and washed dishes to promote tourist safety. During March alone, four visitors became ill. Two were foreigners, but two others were an eminent Indian naturalist and a touring member of the Forest Department.

Regardless of what other measures are adopted, the sanctuary staff need to foster good public relations with the people living on the edges of the sanctuary. The blackbuck were much more trusting in early 1980 than reported the year before, but the chital were still suspiciously elusive. When visitors travel to a park, they want to see the animals that live there. Point Calimere is more accessible than Velavadar and lacks the security afforded by a vegetarian populace. The sympathy of the local people can do more than gates or watchers to safeguard local animals and their supporting plant communities. The Forest Department must be firm in enforcing its regulations for the integrity of the sanctuary, but it can also organize educational activities such as wildlife movies at the rest house free for local residents, slide talks for local groups and possibly a nature walk each year with a picnic for the local children.

Summary

Management options put forward for special consideration at the two major study sites are summarized in the following list:

VELAVADAR BLACKBUCK NATIONAL PARK

- 1) Safeguard *akhali* males from disturbance. (Monitor new entrance road to prevent harassment. Keep visitors from walking into this area. Avoid as much road construction or maintenance disturbance as possible.)
- 2) Limit visitor and all unofficial driving to designated roads. (Maintain visitor road with shaded viewing place at viewing turn-around when groups are present.)

POINT CALIMERE WILD LIFE SANCTUARY

- 1) Monitor sanctuary access. (Post a watcher with a radio at each end of sanctuary and provide the watcher at the far end with a watchtower. Have a patrol boat available.)
- 2) Control vehicular traffic. (Restrict motor travel to one sanctuary road maintained for the purpose. Send a guide with each visitor vehicle.)
- 3) Restrict use by domestic stock. (Keep

- 3) Determine carrying capacity. (Study vegetation availability and palatability for blackbuck.)
- 4) Manage for self-sustaining population kept within carrying capacity. (Continue to monitor carrying capacity to keep informed of fluctuations. Work out age and sex structure of population from skulls of blackbuck that die in park. Trap or shoot excess blackbuck—females as well as males—to keep numbers within carrying capacity. Study habits and population dynamics of predators. Use results to encourage native predators like jackals and to discourage pariah dogs.)
- 5) Improve park food supply for blackbuck. (Prohibit all unnecessary off-road driving. Prohibit any penned animals. Test effect of small border plantings of palatable native grasses and forbs plus wheat and cotton using local labour and methods. Continue *Prosopis* eradication program. Fence park if necessary to exclude domestic livestock and to keep blackbuck from entering crops during growing season.)
- 6) Determine carrying capacity. (Study vegetation availability and palatability for all species of grazers and browsers using the sanctuary.)
- 5) Manage for self-sustaining blackbuck population kept within carrying capacity (Manage Temple Lands along with Reserve Forest. Prevent human poaching; protect natural predators; provide summer drinking water. Collect skulls of natural blackbuck casualties to use in investigating age structure of the population as an aid to estimating the effect of fluctuations in carrying capacity. Continue periodic blackbuck census. Remove surplus animals if carrying capacity is exceeded.)
- 6) Promote good public relations. (Plan programs involving local residents. Enforce sanctuary regulations fairly. Encourage carefully designed projects and outings by Wildlife Conservation Society of Tiruchirapalli.)
- 7) Improve visitor facilities. (Provide viewing platform near the lighthouse and at the far end of the sanctuary. Institute an interpretive program. Improve rest house sanitation.)

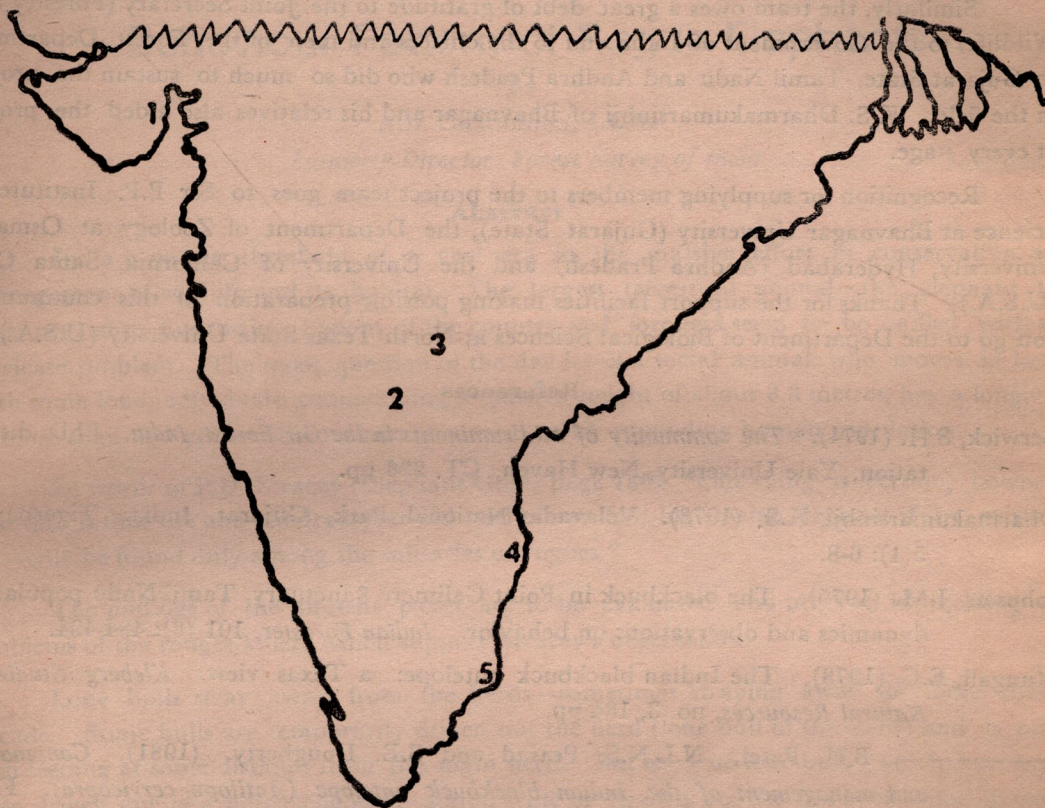


Fig. 1. Five blackbuck areas visited by research team:

- 1—Velavadar Blackbuck National Park, Velavadar, Gujarat State
- 2—Mudmal, Andhra Pradesh
- 3—Mahavir Harina Vanasthali, Hyderabad, Andhra Pradesh
- 4—Guindy Park, Madras, Tamil Nadu
- 5—Point Calimere Wild Life Sanctuary, Point Calimere, Tamil Nadu

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Behaviour Pattern of Rogue Elephants

By

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Abstract

India is on the threshold of a new era in the massive effort in conservation and management of wildlife and its habitat. The largest terrestrial animal—the elephant has been pegged to five distinct regions of the country and foresters seem to be baffled with the intricate problem. The moot question of the day is—if a social animal, who moves in herds with some lone individuals, commanding a massive height of about 3.3 metres, has a longevity of more than 100 years will continue to survive in an expanding human population.

In words of P.D. Stracey (Elephant Gold, page 186) "One thing is certain, however, and that is that the one-hundred-year-old and eleven-foot-high Asian elephant if he exists at all – will be found only among the solitaries or rogues."

The findings of the present paper are to be evaluated and utilized in tackling the problems of the rouges/killers which support Stracey's observation.

Lone bulls stray away from the herds—sometimes straying away for more than a decade. Some bulls are temporarily driven out the herd (lone bull of the herd) and is often seen feeding at some distance from the main herd. But the true lone bull (which has never been driven out of a herd) chooses a solitary life of its own accord has been found to cause large-scale damages to property and are sometimes responsible for the death of human beings and domestic animals too. And yet, all solitaries are not destructive. Quite a few of them are innocent and deserve careful observation and treatment.

The paper also seeks to highlight the salient behavioural patterns of the solitary elephants (rouges/killers) responsible for human deaths and damages to property and attempts at classifying them.

Overall findings reveal that inherent and designed rogues are probably absent; temporary insanity or loss of balance if taken as an inherent character (to be scientifically established) is responsible for a number of deaths and damages: And these are common. Aggressive and adventurous animals are few. Circumstantial rogues are also very common (most human killers).

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In the aforesaid situation, the foresters and wildlife conservationists should give their best thought in dealing with solitaries, killers and rogues. Circumstances leading to such animals turning rogues/killers are to be removed and real bad individuals which are few, are to be identified. A management system for dealing with the situation is to be evolved.

1. Introduction

Indian elephants (*Elephas maximus* Linn.), a noble animal are at a cross road in the history of existence owing to expanding human population, extension of cultivation and shrinkage of its habitat. The psychology of actions of the animals figures in mythology and religion and domesticated more than four thousand years back is still obscure. This animal carried oriental potentates on its magnificently flattened back in State ceremonies. No wild animal has served men more faithfully through the ages and has been made the subject matter of myth and fanciful tales. It is still a puzzle like the human mind and behaviour, how men failed to understand this animal which lies at the very foundation of the country having been a symbol of social life, religious ceremonies and in fact a part of their lives. Docile nature, courage, endurance and freedom from vices are appellations attributed to Indian elephants; yet they occasionally become insane (though sometimes momentarily) and determined killers, marauders, vindictive, monotonous killers, revengeful and are prone to make unprovoked attack with evil design behind and as such the appellation of 'rogues'/killers justify their behaviour pattern.

Lone bulls which are considered dangerous have always been maltreated by men. No factual studies to analyse their behaviour and to check their undesirable actions have been made. It is felt that the attitude and actions towards such animals even twenty years back and now should basically be changed owing to the changes brought about by the machine age.

2. Classification of Rogues/Killers—Is it possible?

Ferocity of tigers, especially of the man-eaters has been the subject of wide range of discussions. Unique among various biogeographical sub-species is the estuarine amphibious, euryphagous and eurythermal tiger of the Sunderbans. According to the behavioural patterns, classifications of such man-eaters, has, however, been done by Chaudhuri and Chakrabarti (Cheetal June, 1972). The classification was based on analysis of innumerable patterns of incidents of human kill over many years. Authenticity of such classification has been proved over the past decade (Appendix I) as no other behavioural pattern observed over the period nullified such observations. It is worth comparing this classification in the context of the present one.

Psychology of rogues/killers

The pattern of killing by a rogue/killer elephant is, however, very much diverse and

the cause and psychology behind each killing are basically different. The kill in the case of a tiger is mingled with the ultimate intention to consume the dead body and to temporarily satisfy itself of its hunger. The pattern of killing in tigers among themselves is basically the same i.e. inflicting severe wound on the left side of the neck, severing the jugular vein, dislocating spinal cord and suffocating the kill. But the pattern of killing in the rogue elephants varies from kicking, trampling, capturing by trunk and smashing under foot or throwing the body away or holding it under foot to pierce repeatedly by pointed tusk; more severe are the vindictive ways of disposal of the dead body which sometimes involves converting the body into a lump, severing various parts of the body and kicking them away at distances and sometimes dumping the body in a hole dug by itself (the rogue), and then covering the dead body by earth or by dry leaves and guarding the body for sometime and thereafter making the exit by declaring its disapproval of human superiority by loud trumpeting.

It must be borne in mind that such elephants are highly temperamental, vindictive and destructive. They are easily upset by noise and easily startled by sudden movement made by external agencies. Tail broom, size of tail, glossy and crescent shaped tail, length of trunk, size of ear, loose body—all these are associated with behavioural pattern of elephants (short or cut tail, too long trunk, small ear, sore at the root of teeth are all associated with their abnormal behaviour).

Elephants do not forget easily; they react sharply to their feeling being outraged; they have long memories for places, persons and associations.

The elephant has a small-sized brain which is incompatible with its body size and weight. Some sort of 'mental black out' is attributed to them when they commit any murder.

Most of the rogues/killers have been found to be tuskers of various descriptions, comparatively a smaller percentage are *maknas* (tuskless male) and in few cases they are cow elephants (domestic).

The tusker rogues/killers are often seen with broken tusks, tusks of dissimilar size and shape (also with other physical defects), tusks at various levels (Tal-betal), either left or right tusk being absent (Ganesh), or tusks with abnormal growth; tails are sometimes missing. In many cases (but this cannot be generalised) the rogues/killers are either tuskers or *maknas* in 'musth'. Injury of various types inflicted upon the body of the elephant by gun shot, fire, arrow (sometimes poisonous arrow), spear and diseases which have been marked on the body of the elephant might have driven them to killing of man. Instances of domestic elephant especially the females which have turned man killers (call them rogue?) are not uncommon; such elephants did not have any evidence of injury or disease on them, not any psychological imbalance was observed in them.

Lone bulls stray away from herds; some bulls are driven out of the herds temporarily. Some true bulls are never driven out of the herds; some such bulls choose to live a solitary life or are forced to do so because they are unable to mate effectively and lack adequate virility. No wonder such bulls will behave abnormally at times, the fact remaining that all lone elephants are not rogues. Maljooriah i.e., lone tuskers and maknas (association of two or three elephant bulls) are not perhaps always rogues though they cause damage to properties and sometimes kill men.

The *build of the animal* influence its behaviour pattern. Koomeriahs, Meergas, Dosalas and various other type classification testify to the quality of the animal. An elephant with 18 numbers of nails in its feet is considered auspicious whereas one with 16 nails is considered inauspicious and a potential killer.

Maknas have psychological and physical handicaps and their behaviour is sometimes worse than that of the tuskers. Maknas form 20% of total male elephant population which is 45 to 55% (Dhui 45% and Sarin about 10%) in North Bengal.

3. Lone bulls—population

Specific study to ascertain the population of lone bulls or maljooriah might not have been made. However, observation about 8 years back in North Bengal revealed the presence of 15 such lones and maljooriah in a resident and migratory population of about 200 elephants. This works out to only 7.5%; and the real notorious were hardly 33% of these lones or say 2.5%. Taking elephant population in India as 14,000 such suspicious bulls will only be 350 which is a very meagre number. Careful consideration may be made as to how to deal with these 350 animals.

Most of the lones are somewhat innocent and cannot be designated as real monotonous killers, vindictive and ruthless marauders. Careful studies of their nature will testify to this observation.

4. Rogues/killers-analysis and pattern of killing and classification

Analysis of the pattern of killing and destructive behaviours of more than 150 cases in the country (mostly in North-east India) over a period of past 50 (fifty) years (including examination of rogue killed) has been made. A few generalised types are as below:—

(i) Elephant 'A' chased a man and struck its pointed tusk, the thrust missed him by a fraction of a centimetre; the pointed tip of the tusk pierced the solid bole of a sal tree and it broke; it had to leave the broken tip behind and retire to the forest; the man escaped unurt. Such incident was not repeated.

"Should the elephant be called a rogue/killer and destroyed?"

(ii) Elephant 'B' followed a man in the forest and killed him; it then lacerated the victim's body by repeated goring; made it into a mangled pulp and kicked it away. Such incident was repeated sometimes.

"Should the elephant be called a rogue/killer and destroyed?"

(iii) Elephant 'C' hid itself behind a bush, took vantage position to initiate an attack. It charged upon the man and trampled him to death; various organs of the body were then severed and thrown all over the forest. The animal tries to repeat such action.

"Should the elephant be called a rogue/killer and destroyed?"

(iv) Elephant 'D' chased a man and killed him by holding him with its trunk and by trampling under its feet; it then dug a hole and dumped the dead body inside it, covered the body with earth and dry leaves; it guarded the body for sometime and then vanished after registering its vengeance by a loud trumpeting. Such incident was not repeated in the locality.

"Should the elephant be called a rogue/killer and destroyed?"

(v) Elephant 'E' damaged road-side temporary sheds/huts of road labourers; destroyed a number of them; such incident were repeated for quite sometime. A few persons died out of fright and some having been suffocated inside the destroyed huts.

"Should the elephant be called a rogue/killer and destroyed?"

(vi) Elephant 'F' was on its usual evening or midnight stroll; a man came very close to it (either under influence of liquor or to offer puja to the Ganesh debta); it casually removed the man from its way by a mild kick; the man died. Such incidence were repeated twice or thrice.

"Should the elephant be called rogue/killer and destroyed?"

(vii) (a) Elephant 'G' killed a man deliberately and another after three years; thereafter no trace of it was found.

(b) Elephant 'H' killed several men under various circumstances at intervals of 3, 5 or 7 years or so. Such action appeared like a "rhythmic pattern".

Should these elephants be called rogue/killers and destroyed?"

(viii) Elephant 'I' was a decile departmental cow elephant which rendered long years of faithful service; it suddenly ran amuck and killed its mahout; immediately after this it retrieved its position in the pillkhana. Such incidence was not repeated.

"Should the elephant be called a rogue/killer and destroyed?"

(ix) Elephant 'J' was a faithful departmental female elephant having long years of spotless service to its credit (i) while on graze it killed its mahout; (ii) while on way to graze it killed a road-side shopkeeper; both the incidents were apparently unprovoked. It continued to behave normally thereafter.

"Should the elephant be called a rogue/killer and destroyed?"

(x) Elephant 'K' was a solitary bull; is uprooted trees of similar diameter at intervals all over the forests in a uniform pattern in its daily trekking; killing of men or damaging of properties was outside the sphere of its action.

"Should the elephant be called a rogue/killer and destroyed?"

(xi) Elephant 'L' was a solitary bull, it grazed all over the forests around the year. Record of some damage but no kill was attached to it.

"Should the elephant be called a rogue/killer and destroyed?"

(xii) Elephant 'M' was a solitary bull, straying but close to the herd; it caused widespread damage to buildings, pipelines, water tanks, stores, vehicles; it was responsible even for the death of human being (indirectly).

"Should the elephant be called rogue/killer and destroyed?"

(xiii) Elephant 'N' a Dhui (mother with calf) or a Sarin involved in destruction of property or even killing of man (indirectly) in order to trace back the calf who led by curiosity entered into some huts in their migratory tract. Such incidents are often repeated.

"Should it be called rogue/killer and destroyed?"

The foregoing thirteen type examples give an overall picture of philosophy and psychology behind the behavioural pattern of the killers called either or not rogue/killer (Rogues are not always killers; killers are sometimes rogues).

To find out what could be the psychology of the animal at the time of killing is a researcher's job. But externally induced injury, festering sores which are maggot ridden, morphological defects, imbalance and irritation arising therefrom are positive causes of psychological imbalance.

Does the lunar cycle on diurnal or nocturnal variations induce psychological changes? So far it is not known and there is no evidence to support the first presumption; analysis reveal that most of the kills are made at dusk or early to mid hours of the night.

Statistics show that about 75% of human beings killed are men and 25% are women. The reasons are obvious. Number of persons killed by 14,000 elephants in India annually would not exceed 40-50.

Partial or total madness are not acquired characters. Temporary loss of sanity or balance is an important characteristic and it is a subject of research as to why this condition occurs? Do hormones play any part or temporary black out in brain is responsible? (Behaviour of *Homo sapiens* is comparable in this regard.)

The elephants have ability to recognise objects after long intervals and it can distinguish one specific tone and colour from another. Any undesirable behaviour of the mahouts meted out to domestic elephants is sometimes retaliated; people constructing structures in the elephant tract (wild elephants) are definitely responsible for elephants expressing their disapproval by demolishing or damaging such structures or even killing men in the process.

Repeated hostile actions of human being meted out to the animal have emboldened the elephants to face fire, fire-arm crackers, bombs thus resulting in drastic change in the pattern of their behaviour. Filial affection is of high order with elephants death, capture or injury to calves have brought changes in this behaviour and there are evidences of adoption of retaliatory steps by the herd (capture of calves in mela or kheda shikar).

It must be borne in mind that a huge creature may often cause substantial damage or death in a playful mood. Wrong and avoidable actions or even unintentional provocation by man at the sight of the huge creature may cause death (suicidal action of man). Curiosity of the calves or even that of the adults may sometime be responsible for damage or death. Elephants in 'musth' are associated with unbalanced behaviour as they acquire abnormal strength and ferocity at that time. Instances of periodic madness have been observed in domestic elephants; and are likely to be prevalent amongst the wild (rhythmic pattern of madness).

Classification of rogues/killers is extremely difficult (unlike classification of man-eaters in Sundarbans (as in Appendix I); in the case of elephant psychological factor, momentary madness or imbalance, retaliatory tendency, past treatment etc. play major roles in its behavioural pattern. One is wild (tiger), the other also wild but have thousand years of domestication and human association behind it.

Grouping of 150 case studies of behavioural pattern of rogues/killers have been made into fourteen patterns as described earlier (Elephants designated 'A' to 'N'). These fourteen patterns have been grouped into five broad types as follows (see also Table 1):—

- | | |
|---------|---|
| Type I | Temporary loss of balance or loss of sanity which causes it to kill men or destroy property. Deep rooted causes could be responsible for such behaviour.
Frequency of incidence—Moderate 22%.
Example as in pattern Nos (i) (and viii). |
| Type II | Physical deformity in tusks, tail, tooth, morphology of body etc. is responsible for abnormal behaviour. |

Frequency of incidence—Common 25%

Example as in pattern Nos (vii), (xii), (ix) may be (i).

Type III Adventurous/curious ones which damage property and causes death.

Frequency—Low 10%.

Example (v), (x), (xiii).

Type IV Habitual killer who are vindictive, determined killer having evil design.

Incidence of occurrence—very low 8%.

Example Nos. (ii), (iii).

Type V Circumstantial rogues/killers; elephants in musth.

Frequency of occurrence—commonest 35%.

Example Nos. (iv), (vi) also (iii) and (xii).

5. **Specias study group:**

The Forest Department, West Bengal, may be also some other states, has taken timely and a judicious steps in forming specialised squads for study of the movements of elephants and to adopt appropriate steps to combat various situations. Such groups will be able to study in depth the behavioural pattern not only of rogues/killers, but also of herds, take photographs and notes on lone bulls, (for facility of identifying notorious killers) and suggest adoption of appropriate measures.

6. **Conclusion:**

From the study it will be revealed that (i) Temporary insanity or loss of balance, (ii) Deformity and (iii) Induced injury are responsible for turning elephants into rogues/killers. Rogues are killers and destroyers of property; killers are those that kill man and animal (elephant kills dogs and cows also). Notorious lone bulls or maljooriah form only 2.25% of the population, and as such tackling of such lone bulls must not be a big problem.

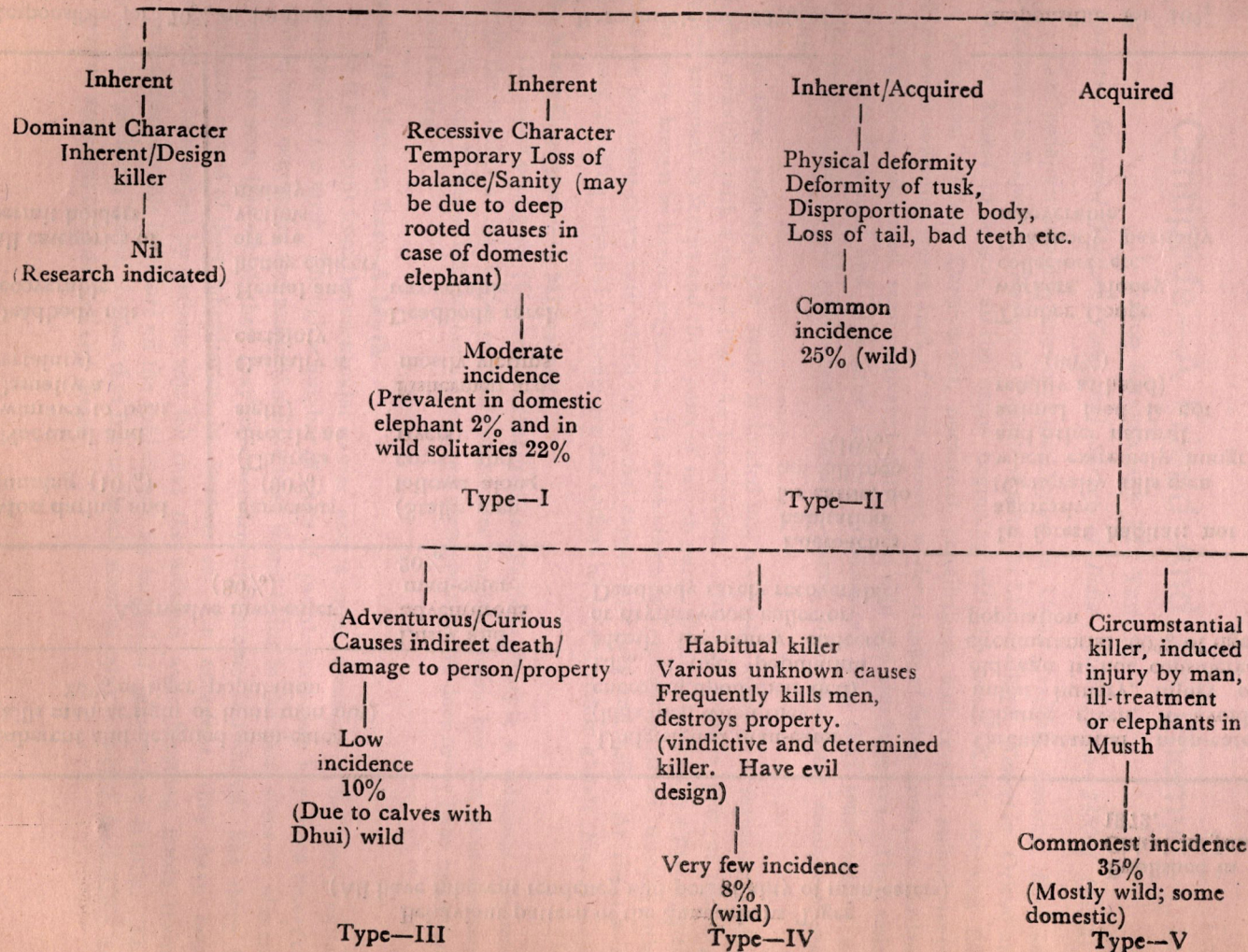
Fear complex and vested interests of a section of people compel adoption of drastic action, but careful study and active manipulation of the situation are bound to ease out the problem to a considerable extent.

Elephant habitat has shrunk. Large forest blocks have been depleted and broken into smaller fragments. Animal herds are being subjected to maltreatment. There is dearth of hiding or secluded resting places for the herds or even for the solitaires. As such, individuals or even herds are seeking shelter in these isolated pockets of forests. This situation will lead in near future to fragmentation of herds and more and more of lone elephants.

Management problem of elephants will be extremely difficult in the present situation. Special management systems have to be evolved for management of solitaires and over crowding. The problems of maltreatment by men have to be separately dealt with. Real rogues/killers are few. Few may have to be destroyed. Other could be captured and put to use.

The process of evolution has brought this animal on earth far ahead of man and as such they have superior claim to live. Let us co-exist.

Table I
Classification of Rogues/Killer Elephant



Behaviour pattern of the Sundarbans Tiger
(All have inherent tendency and potentiality of man-eaters)

Published in
Chital in June
1972.

Inherent and designed man-eater
(kills man at sight or hunt men out)
25% of tiger population

Undersigned man-eater
(kills men when they
encroach upon their den)
15% of tiger population
Mostly the honey collector
or dry firewood collector.
Deadbody rarely recoverable.

Circumstantial man-eater
(Chance given, it avoids
unless hungry, injury or
old age is not considered
circumstantial 60% of tiger
population)

Aggressive man-eater
(80%)

Lusty and
adventurous
man-eater
20%

Most daring and
cunning (10%)

Ferocious
(90%)
(Charges
directly at
sight)

(Stalks men,
follows along
creeks and
rivers)

Encroaches
habitation
for cattle, do
not kill men
(10%)

In forest habitat; not
aggressive.
(Generally kills men
when extremely hungry
and other natural
animal food is not
readily at hand)
(90%)

Deadbody not
recoverable

Casualty a
certainty

Fishermen are
mostly victims

Deadbody rarely
recoverable

Timber Coupe
workers, Honey
collectors etc.,
Deadbody partially
recoverable.

All categories of
permit holders

Hental and
honey collect-
ors are
victims
mainly

Responsible for 70% of human
casualty.

Responsible for 20% of
human casualty.

Responsible for 10%
of human casualty.

N.B. Only 28.5% of the total dead is recoverable,

Centipede—A Friend And An Enemy

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Centipede, vernacularly known as *Kankhajura* in Uttar Pradesh, *Kansala*, *Kansalava* or *Kanhalya* in Rajasthan, *Kankol* in Punjab, *Kansui* in Maharashtra, *Kennri* in Orissa and *Kenno* or *Kennoi* in Bengal, all the terms beginning with the word 'KAN' meaning Ear, is a poisonous, solitary, Carnivorous, nocturnal, cannibalistic and cryptic animal taking refuge under cowdung, stones, bark of trees, mosses, under trunks of fallen trees, in gardens, kitchen gardens, cultivated, semi-cultivated, fields or in wild and also in caves. Their vision is very poorly developed and of a little sensory importance. The chief sense organs are tactile consisting chiefly of highly sensitive bristles, spines, hair and some exoskeletal outgrowths.

In these animals, the body is divided into a variable numbers of segments, each of which is provided with a pair of limbs for locomotion. The head bears a pair of multisegmented antennae or feelers and three pairs of mouth parts. Behind the head is a first segment of the body, known as basilar segment. Its appendages are maxillipedes or toxocognaths. These are poisonous claws with which the animal captures its prey and kills. At the tip of their strong, piercing terminal segments are the orifices of paired venom glands (Fig. 2).

The Name Centipede—A Misnomer

The name centipede (Centum = Hundred and Pedis = Foot) is a misnomer, because though the number of legs varies from fifteen to over hundred pairs but the most common centipede (Fig 2) whose vernacular names have been given above does never have more than 21 pairs of legs.

Enters the Human Ear—A Myth

As it is evident from the vernacular names and a most common belief that it enters the human ear *is a myth*. Though a number of cases of pseudoparasitism have been recorded in which, both centipedes and millipedes have been found living in the nasal sinus or alimentary canal of man, into which they may have accidentally become introduced, but there is no authentic record of their inhabitation in human ear. On occasions, they have been vomitted up in numbers by patients who felt that the animals were breeding inside them. There is a considerable literature on the subject but its biological importance is little. The explanation probably lies in the fact that the centipede seem to exert a weird fascination on the morbid appetites of hysterical and insane.

Centipede—A Friend

While millipedes are pests of many agricultural crops, the centipedes tend to become beneficial to farmers and gardeners as predators upon the pests of crops and plants. It is also evident from the literature that they have been found eating on millipedes, grubs of some harmful Coleopteroid beetles, larvae of butterflies and moths, termites and even small lizards and birds.

Centipede—An Enemy

On account of their retiring habits centipedes tend to escape notice and their poison also protects them from their enemies. There are numerous scattered accounts of the ill effects of their bite. The poison apparatus is formed by the modification of first segment of the body to form a pair of jaws, at the base of which is situated the poison glands (Fig. 2), which communicate with the tip of claw like process by means of a duct. The poison is an opalescent liquid acidic in nature, which has an intensive corrosive local pains. Small children have been known to die from the effect of sting, whereas, with timely first aid, the adults recover within 24 hours. The centipede biting have been known to cause Oedema, Lymphangites with inflammation of skin and subcutaneous tissues and ulceration, and in most cases a localised necrotic process takes place. Application of Tincture iodine or rubbing in of the crystals of Potassium permanganate or Liquid Ammonia, after making a nick between the two punctures may serve as a first aid. If the first aid is not given to the victim immediately, a gangrenous sloughing may start.

It is said that the poison when injected into the veins of Rabbit caused an immediate paralysis with coagulation of blood, while under skin it formed large abscess.

The effects of poison, both local and general are very pronounced and the development in symptoms can easily be followed stage by stage. Locally, at first, there is a simultaneous sensation of heat and tingling, which is superseded by intensive pain, radiating up and down the limb. At points of inoculation two red spots of blood appear, which within 24 hours enlarge and disclose necrotic areas. The necrotic ulcer keeps enlarging till about the fourth day, when it becomes circular or oblong in shape exposing about 8 cm of slough with a further undermining of skin about 2.5 cm round, resulting into a very high fever and vomiting.

In the University of Punjab, Chandigarh, researches are being carried out to analyse the chemical composition of poison.

Locomotion

The locomotion of centipedes has long fascinated Biologists. Ray Lankester in 1889 derived the conclusion that if the animal had to settle the question himself, he would not get on at all. He further said that,

"A centipede was happy quite
 Until a toad in fun
 said, "Pray which leg moves after which?"
 This raised her doubts to such a pitch
 She fell exhausted in ditch,
 Not knowing how to run."

Reproduction, Parental Care and Cannibalism

Though details of reproduction in these animals have not been studied closely but it has been seen that they exhibit a remarkable degree of parental care (Fig. 3), at the same time when disturbed the parents devour their brood.

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1. The centipede *Scolopendra* sp., in dorsal view.
2. Head of the centipede (in ventral view) showing the position of the poison glands.
3. Portion of the centipede exhibiting parental care.

Bird Mystery of Jatinga

CAPT. S.R. BANERJI

Jatinga is a small Khasi village located in the North Kachhar district of Assam, approximately 8 km from Haflong. One may reach this village either by road or by rail from both Gauhati and Silchar. This small innocent village has recently come to limelight due to so called mass suicide by birds attracted by artificial light.

It is believed that sometimes during the early twentieth century, on a dark night, a group of villagers went to search for a buffalo which was alleged to have been lifted by a tiger. As the villagers were walking with fire lit torches, flocks of birds of different species flew towards the amazed villagers and sat on their heads and shoulders. The villagers, taking the phenomenon as gifts of God, killed and ate them. A number of years have passed since then, but the system of attracting the birds by artificial light like petromax lamps and later killing and eating them still continues. However, the number of birds being attracted has been much reduced due to a general reduction in their numbers.

In order to study this peculiar phenomenon, a team of naturalists from the Eastern Region of the World Wildlife Fund-India decided to pay a visit to Jatinga during early August 1981. The team was led by Mrs. Purnima Dutta, the projects officer of WWF-India (Eastern Region) and the main spirit behind the project. The other members of the team besides me were Dr. Pinaki Chatterjee, a famous explorer, Dr. Srikumar Chatterjee, a keen Zoologist from the Zoological Survey of India, Kushal Mukherjee, an amateur Zoologist, Amitabh Roy, keen photographer naturalist and few other naturalists, both men and women.

We reached Gauhati on the evening and were lodged in the Forest rest house. On the following morning we started from Gauhati in forest department vehicles. Towards the afternoon we reached Lumding from where a long and lovely stretch of forests began.

We reached Haflong in the evening after a drive of nearly 300 km. We stayed in the District Council guest house.

We got busy in our schedule of work from the next day. We moved among the villagers and interviewed people about the killing of the birds. Srikumar and Kushal got busy in collecting specimens. We spent a few nights in the watch tower constructed under the guidance of Mr. Phukan, the devoted DFO. A search light of 1000 watts had been fixed on the watch tower to attract birds.

The ideal condition to attract birds by artificial lights on dark foggy nights with strong wind blowing from South West to North East. Birds are not attracted to light when nights are not absolutely dark. On such dark and foggy nights the villagers mainly comprising of youngmen make preparations for the killings. They make small thatched sheds outside the village and wait there in small groups with petromax lamps, bamboos and nets. The birds are attracted by the lamps and on nearing them they get momentarily dazzled. Taking advantage of this, the villagers kill the birds by striking them with bamboos or catch them by spreading nets over them. However, it will be wrong to assume that the birds commit suicide since once the presence of the human beings are discovered, the birds fly away. On a number of occasions we have tried to go near them only to find them vanishing back into the darkness. We also experienced that more number of birds are attracted by the powerful search light than by the comparatively dim petromax lamps. As a result, the villagers do not sit anywhere near the watch tower.

Now what is the mystery behind such peculiar phenomenon? There are various theories put forward like effect of geomagnetism, hormone secretion and many other factors. However, certain reasons for the peculiar phenomenon can also be due to the underlined factors. Jatinga Valley is surrounded by mountains in a U. shape. The altitude of the place is approximately 5000 ft. from the sea level, the distance from the sea (Bay of Bengal) beigh only 100-150 km. From the month of June up to early September, South West monsoon pass through the Eastern Indian subcontinent towards the North. Due to this reason, dense fog is formed resulting in very poor visibility. The wind velocity is also high. A number of air pockets exist in the region. When there is strong wind, the birds get dislodged from their nests at times. Due to very poor visibility, the birds find it difficult to find their nests. At that time bright lights attract them probabaly to aid their navigation. Our investigation in the subject revealed that neither the nocturnal birds, nor the birds of prey have been recorded falling victims to the mass killings.

Some of the common species recorded by us in Jatinga are as follows:—

Cattle egret (*Bubulcus ibis*), Himalayan cuckoo (*Cuculus saturatus*), spotted dove (*Streptelia chinensis*), emerald dove (*Chalcophaps indica*), three toed kingfisher (*Ceyx erithacus*), Ruddy Kingfisher (*Haleyon coromanda*), honey buzzard (*Pernis ptilorhynchus*), shikra (*Accipter baaius*), black eagle (*Ictinaetus malayensis*), common pariah kite (*Milvus migrans*), bluthroated barbet (*Megalaima asiatica*), golden throated barbet (*Megalaima Frankilnii*), himalayan great barbet (*Megalaima virens*), black headed oriole (*Oriolus xanthornus*), small yellownaped woodpecker (*Picus chhorolophus*), large yellownaped woodpecker (*Picus flavinucha*), himalayan tree pie (*Dendrocitta formosae*), jungle crow (*Corvus macrorhynchos*), brown shrike (*Lanius cristatis*), rufous backed shrike (*Lanius schach*), ashy swallow

shrike (*Artamus fuscus*), large cuckoo shrike (*Coracina novaehollandiae*), scarlet minivet (*Pericrocotus flammeus*), goldfronted chloropsis (*Chloropsis aurifrons*), redvented bulbul (*Pycnonotus cafer*), red whiskered bulbul (*Pycnonotus jacopus*), iora (*Aegithina tiphai*), tree sparrow (*Passer moutanus*), magpie robin (*Copsychus saularis*), chestnutbellied nuthatch (*Sitta castanea*), grey drongo (*Discrurus bucofphaseus*), hair crested drongo (*Dicrurus hottentottus*), Indian myna (*Acridotheres tristis*), jungle myna (*Acridotheres fuscus*), grey headed myna (*Sturnus malabaricus*), large greenbilled malkoha (*Ropodytes tristis*).

The mass killing of the birds need to be stopped. Forest Department of Assam has already taken steps in the right direction. However, the main problem faced by them is that the killings take place in the private owned lands. Though due to general reduction in their numbers, the birds slaughtered is much less in number than earlier. Moreover, electric lights in the township of Haflong also have created diversion for the birds. Even after all these, killing still takes place. Stopping this killing by legislation will have its own drawbacks. Hence, there is a need to spread wildlife education among the younger generation by showing films, illustrated talks, teaching in schools, nature clubs and so on.

Pug Mark Census

By

O. JAYARAJAN

Kerala

Introduction

The census of tigers and other felines based on paw impressions is being subjected to criticism both inside and outside the Country and interestingly enough several "Critiques" have failed to substantiate their claim. On the other side veterans in this field vouch for the reliability of this method. An objective analysis of the fact shows that in Indian conditions pug mark census is the nearest to reality, though it entails painstaking work at every step. This study is intended to relieve the task of the Co-ordinator who is organising the census work and who shoulders the responsibility of submitting the accurate figures, eliminating duplication on which maximum criticism is faced.

Study Area and Method

2. The difference in the paws of tiger, panther and lion, the difference of male and female paws and that between front paw and hind paw could not be studied during study period. *In vivo* study on these facts was intended to be done in Delhi Zoo. However, some practical problems precluded the possibility of undertaking such a study. Hence existing norms are applied here also.

3. The study area mainly includes Dudhwa National Park of Uttar Pradesh. Tiger Reserves of Kanha, Rantham-bore, Corbett, Simlipal and Palamau and National Parks of Tadoba and Shivpuri also form parts of study area. The problems occurring in the field to locate the track, distinguish the hind pugsmark, measure the stride, trace the impression etc. have been subjected to study and analysis.

4. Tracing of 132 pug marks of tigers and panthers and plaster casts collected in Wildlife Research Institute, Dehra Dun have been subjected to studies. This includes 35 tracings from Melghat Tiger Reserves collected by Shri V.B. Sawarkar, previous Research Officer of the area and presently Senior Research Officer, Wildlife Institute of India.

5. The study has been inclined to avoid personal errors at various steps of the census work.

Methods Used in Pug Mark Census

6. Perhaps the first enumeration of tigers based on pug mark counting might be conducted by W. J. Nicholson of Imperial Forest Service in Palamau of Bihar in 1934, which gave 32 animals for an area of 299 sq. kms.

7. Dharma Kumar Singh ji (1959) advocated track method followed by baiting and driving census for tiger, lion, and leopard. In the track method the beat guard should collect measurements of diameters of the pads of front feet and measure of the reutangular measurements of the front feet and ascertain whether the animals are males or females. The method had been used for Gir Lion Census subjected to modifications based on subsequent techniques.

8. The three stick method measuring length along the midline (base of the pad to tip of the inner toes), width of the outer toes and width of the pad, had been in use till 1973. The method has been rejected since the margin of variation was unpredictable.

9. Sankhala (1967) devised an instrument, a combination of Camera spool system and a cavalry board on which thin cellophone transparent paper can be run through for tracing and preserving the pug marks. He named it as pug mark tracer.

However, this instrument was not used in the field for census purpose. The instrument can meet the requirements of research scholars in the field to trace and preserve maximum spoors with minimum inconvenience.

10. S.R. Choudhary (1971) designed and evolved the "Tiger Tracer"—a simple glass piece of portable size with four adjustable props at the corners to trace the pug marks in the field.

The instrument was first widely used in the Country for the Co-ordination Tiger census (Choudhary method) in 1972. Since then tiger tracer is being used as the most applicable instrument for tracing of pug marks.

The pug marks are first traced over the tiger tracer and then carefully transferred to a tracing sheet to preserve it permanently, recording all the necessary data on it.

The Locomotive Pattern and Impression of Paws

11. Locomotive pattern is one of the important parameters in tiger census along with paw impressions of the animals. The tiger is one of the most studied animal among all cats and maximum literature about the gait and placing of the feet is on tiger than any other felines in India.

12. F.W. Champion (1933) quotes from an old book of Tiger hunting, the gait of a tiger has a function with its predatory efficiency, in performing a silent stalk. The eyes being over the fore feet, the animal is able to pick the spots on which to place its forefeet where they will make the least noise, and the hind legs repeat the same spots usually to avoid the chances of any unexpected noise. Thus a tiger normally gives the trail similar to that of a biped. His own observation in Lansdowne division showed 60% of super imposition of pugs, over shooting ranged from $\frac{1}{2}$ " to 6" in a total count of 400 tracks.

13. Champion further describes the walk of a tiger as ambulatory gait with the two legs of one side are simultaneously in motion and alternate with the other side pair as in camels. Dunbar Brander (1934) fully agrees with this findings.

14. Harish Chandra (1970) who studied the tiger pug marks in movement mentioned that in a majority of cases an impression of the hind foot does not cover the impression of the forefoot entirely. Hind foot does fall in front of the forefoot in a normal walk, but the impressions vary in their gaps and distances.

15. Sankhala (1978) also describes that the tiger walks with both side limbs lifted together, like a camel. The argument is substantiated by the photograph of a tiger lifting the limbs of one side together. He agrees with Hicks and Champion that tiger's hind pug marks are similar to the front pug marks of a tigress. For census he insists on recording of the front pug marks since it is used in killing and eating.

16. Choudhary compares the gait of a tiger to the working of pistons in a four stroke engine naming the limbs from front left as 1, 2, 3, and 4 in clockwise direction. In the walk, the pattern of placing of limb will be 1:3:4:2 repeated in a cycle. The same pattern is observed in other animals like elephants also.

17. *In vivo* observations on the gait of felines at Shivpuri, Boriblli, Joshipur (Khairi) and Delhi Zoo clearly proves that the tiger's or panther's locomotion is not ambulatory. Still photograph of a particular pose of a tiger cannot be taken as an evidence for its locomotory pattern. Perhaps the famous film 'Tiger Tiger' where the tiger's gait is shown in slow motion will clear the doubts of the people who argue that the tiger's walk is ambulatory.

18. It is not mandatory that the hind paws should always super impose the front paws in normal walk. Of the 10 different tracks studied in Dudhwa, all showed clear over shooting for more than 60% in each track. The over shooting ranged from 4 cm to 17 cm. The terrain of Dudhwa is flat with soft and sandy soil on the roads which might be one of the factors for the tigers to walk without much caution to avoid noise. Whereas in places like Kanha and Corbett, super imposing was found more than overshooting.

19. Panwar (1980) following Choudhary (1971) has insisted the necessity to trace the hind pug mark only for the reason that the front pugs will be obliterated by super imposing. The procedure had been followed since co-operation tiger census.

Use of Pug Mark in Field Investigation

20. Jim Corbett (1944) was one among the pioneers who utilised pug mark evidence^s maximum for field investigations and in tracking down man eaters.

21. Harish Chandra (1970) opines that a man eater avoids leaving behind his pug marks by leaping over the open paths and cleverly keeps to hard ground which makes a

comparison between normal and abnormal tigers difficult. He obviously does not wish to leave a back trail for a hunter to follow.

22. Sankhala (1980) mentioned that tiger is a soft padded animal which prefers to walk on soft soil and clear paths to avoid injury to the paws by thorns and sharp stones.

23. Shaik and Viswas Sawarkar, (1979) concludes that even in the absence of sophisticated equipment and techniques it is possible to chart the movements of tigers with the help of their pug marks, detailed tracking and locating the outer most points of movement on a map.

Stride and Straddle

24. Praben Bang (1979) in Collin's guide to animal tracks and signs defines the stride as the distance from the front edge of the foremost foot prints in a group to the front edge in the following group.

25. Indian stride (Choudhary method) is measured as the distance between the impression of left front and right front or left hind and right hind, toe to toe or pad to pad. In case of over shooting half the distance overshoot is added to this.

26. With Indian Conditions where continuous tracks are hardly available on the rough terrain, it appears to be better to measure the half stride only or the distance between front limbs or the hind limbs. Since the feline gait is giving a bipedal effect, there is no harm in measuring the half stride, which can be more popularly coined as Indian stride. In fact this stride is adopted in the co-operation census technique since 1972 and has proved itself as an important parameter which helps sorting out individuals from a series of tracks.

Field observation proves that forefoot paw will be more or less obliterated and hence it is better to measure the stride on hind foot, as the distance from the rear edge of the pad of the left hind paw to the rear edge of the pad of the right hind paw. The inside should be an average of minimum 6 measurements.

27. In census method based on pug marks it is understood that the straddle seldom gives a clue for identification of individual animals. In most cases the track is a single broad line without leaving much distance between the right and left prints.

Further any difference in straddle will be in terms of millimetres which when measured in field will magnify the errors. Hence the suggestion is that straddle as a parameter can be ruled out.

Preservation of Pug Marks

28. Initiators of pug mark census stressed upon the role played by the field men who preserve the impression either by tracing it or plaster casting. His eyes should be highly

trained to locate the pug marks, track them down, differentiate the hind and front ones, identify them in different soil conditions based upon the basic shape and above all he should be able to trace the mark in the correct way avoiding parallax error, and doing the visual-mental reduction in case of splay due to soft soil. Every forest Guard or other field man cannot do this job. Some times talented but illiterate men perform better than learned forest officers.

29. Panwar (1980) solves the problems as follows:—

"A suitable number of tracers who have an intimate knowledge of the area should be detailed early morning every day allotting them specified tract for survey for locating the tiger tracks. The trackers should be previously instructed to "preserve" the pug marks. This can be done for example, on a road surface by cordoning off a small stretch of well defined pug marks with boulders or sticks. Tracing work should be entrusted only to well trained and experienced hands having good mobility to reach different areas on receipt of information from the trackers. If no single pug mark is seen in perfect condition the tracing should be made from the best one and this should be corrected in the field by placing the plate on one or two other pug marks having those segments in good conditions which were found disturbed in the first.

30. Plaster casts may be taken in case of pug marks of dubious identity and also the atypical ones with unusual twists or other defects. Subsequent experiments can be done over these, once preserved in plaster cast models.

The Pug Mark Tracer

31. The pug mark tracer is the modified form of the tiger tracer. This is in no way connected with the pug mark tracer designed by Sankhala in 1967. The reason to give a new name to this model is to justify the status of other members of the feline family like leopard, lion, lesser cats etc. Besides the instrument can be used for enumeration of other animals like bears etc. in India. The name "Tiger tracer" boosts the significance of tiger census only.

32. Basically pug mark tracer is transparent glass plate of 25 cm × 20 cm × 3 mm fixed in a wooden frame of one cm thickness (Figure 1) as the tiger tracer. Over the glass plate a thin vertical and horizontal line are grooved underneath in black respectively known as 'Y' axis and 'X' axis. This divides the plate into four quadrants from A to D in clockwise, starting from left upper quadrant. The glass plate is fixed in level to the rim of the frame to get an even surface. Over this frame another thin frame is fixed about 3 mm thick leaving a small slit of about half a mm sufficient enough to run the thickness of a nylon thread along the vertical and horizontal sides of the frame just touching the upper side of the

glass. The upper frame will be graduated along length and breadth starting from the left bottom corner.

Two vertical nylon threads parallel to 'Y' axis and two parallel to 'X' axis will be fixed between the slits of the upper and lower frame, so that the threads can be conveniently brought in-wards or outwards with in the frame over the glass plate. While tracing the pug marks the threads will be along the marginak of the frame. After tracing, the threads will be slid towards the pug marks until they are tangential to the pug mark on all four sides. Length and breadth can be measured with this arrangement in the field itself.

33. Apart from the measuring of the pug mark in the field, another advantage of pug mark tracer is to measure the degree of deviation of the pugs on the ground. This is to quantify the inclination in the pug mark to the direction of walk which must be varying from animal to animal.

34. The method of tracing with the pug mark tracer is of utmost importance. Parallax error should be reduced to the minimum or nil. This screws attached with the tiger tracer is removed in this equipment, to reduce the parallax error. The distance between the lower bottom of the glass plate and the ground will be about 5 to 7 mm providing sufficient space not to distort the relief edge of the pug mark, in level ground with normal soil. In extreme case of relief edges, pieces of stones or wood will serve the purpose of screws which are found cumbersome in the field.

The tracer should kneel over the ground so that his eyes are vertical with the pug mark tracer along with the pug mark underneath it. The 'Y' axis of the pug mark tracer should be placed exactly bisecting the third toe (Mid toe) of the pug mark with the 'X' axis tangential to the apex of the pad (Fig. 1). The position should be verified and fixed firmly by pressing the frame to the ground. Care should be taken that the relief edge does not touch the glass plate. Tracing should be made very accurately along the outlines with a free flowing pen, taking care to avoid parallax error by moving the eyes with the pen so as to keep always the line of sight vertically above the segment under tracing. After tracing, measurement of the pug marks can be taken on the spot with the pug mark tracer as described below.

Standardising Measurements:

35. The measurement of the pug marks is said to be standardising (Choudhary 1981) (Personal discussion) in India with the graph paper system. The advantages and disadvantages of this method are not covered under the study. But obviously it is difficult for the field staff to do it in the field itself. Hence a simple method of doing in the field as well as in the office is mentioned here.

36. The pug mark tracer should be placed over the pug mark in the field or the traced sheet in the office, with the 'Y' axis bisecting the 3rd toe and 'X' axis tangential to

Fig. 1
The Pugmark Tracer

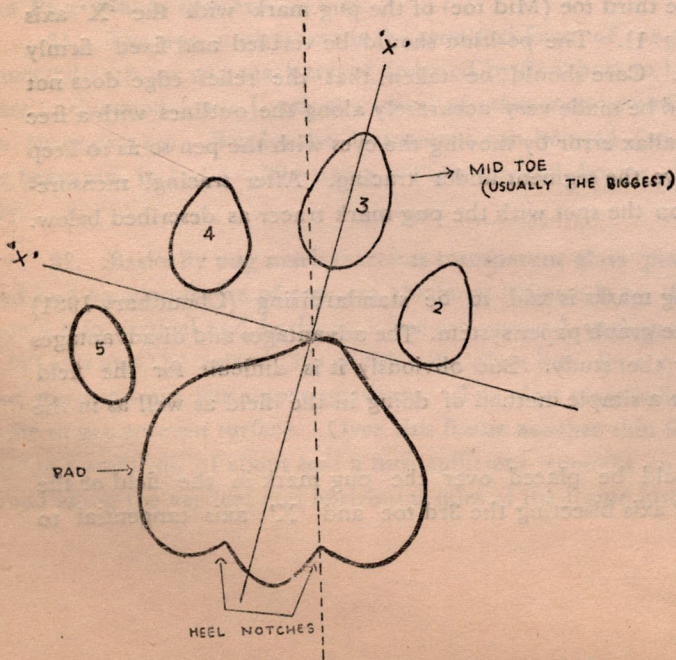
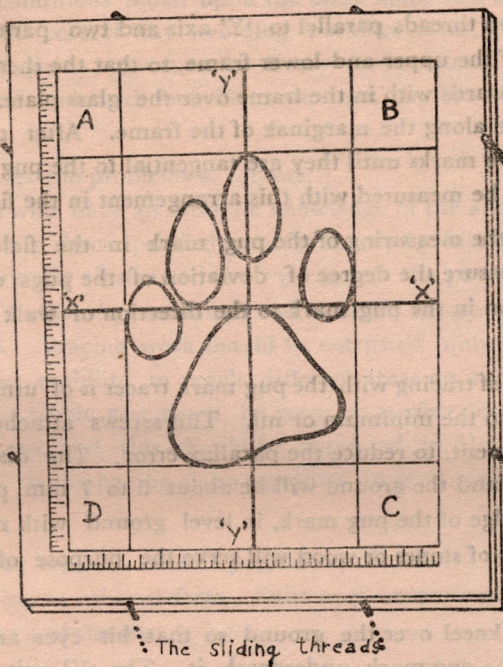


Fig. 2

The angle subtended by 'Y' axis to the dotted line in the degree of deviation of the paw from the general direction of the movement. The dotted line represents the direction of walk of the animal.

the apex of the pad. The threads are slid towards the pug marks so that they are tangential to the outer edges along the length and breadth of the pug mark (Fig. 1). Care should be taken to avoid parallax error on each side. The length and breadth can be measured either by a scale or by the graduated margin of the pug mark tracer.

Measurement of paw and toes also can be easily taken with the equipment. In future even a key can be prepared classifying pug marks on the basis of paw length and toe advance, and also corresponding widths.

37. Chances are more that a man in field comes across the pug mark of the same tiger in different places. At first sight he may not be able to distinguish it. In such cases pug mark tracer can be used over the pug mark only to measure it without tracing it. If the measurement and the general shape of the pug mark tally with those in his previous tracing, he can straight away avoid the duplication in the field itself. In this context it should be mentioned that measurements of pug marks of the same tiger varies slightly depending upon the mode of walk, soil and the error involved in taking the measurement. But when different parameters like shape of pug mark, degree of deviation, stride, overshooting frequency etc. are taken into consideration, the problem of duplication can be solved in the field.

38. The obvious advantage of this method of measuring is the total elimination of personal bias. In graph paper method, bias may come into scene in placing the pug mark, which is done usually in north south directions, whereby the degree of deviation of the pug mark does not come in to picture. This will some time give a difference in length especially when pad has got an asymmetrical shape. Using pug mark tracer caution is to be taken to locate to mid toe and to see that 'Y' axis exactly bisects the toe from the apex to the bottom and the 'X' axis cuts the upper margins of the pad tangentially. Some atypical toe shape only will create any difficulty here. One should not be biased to place the tracer in such a way that the 'Y' axis always bisect the pad also which is not the case usually.

Degree of Deviation to Direction of walk

39. The general pattern of inclination of the hind pug marks is found inwards in most cases. The placing of foot differs according to the ground and also while changing direction. It must have a function even to the sighting side of the animal. But in normal and straight walk the inclination may be uniform.

40. Using the pug mark tracer the degree of deviation can be measured and marked in the tracing. The direction of walk should be marked in the centre of 'X' and 'Y' axis, either with the help of a second man to align the direction at a distance of about 25 metres or with a string stretched along the tracks passing through the centre of X and Y axis. The maximum and minimum variation in the deviation also can be noted by repeating the procedure on various other pug marks in the same tracks. (Fig. 2).

कहानी जो सच बन गई

(मैं और घड़ियाल परियोजना, मध्यप्रदेश)

मेरी प्राथमरी शिक्षा ग्रामीण अंचल में हुई। हमारा गाँव चम्बल नदी के समीपवर्ती इलाके में होने के कारण उस समय परिवार एवं पड़ोस के बुजुर्ग जंगली जानवरों एवं मगर घड़ियालों की कहानियाँ सुनाया करते थे। गाँव की भाषा में घड़ियाल को तुमरिया मगर कहते हैं। मुझे आज भी याद है कि कहानियाँ सुनकर मैं किस प्रकार भय से सिहर उठता था, किन्तु फिर भी इन कहानियों में कोई न कोई ऐसा पृच्छन्न आकर्षण अवश्य था जो मुझे भयभीत करके भी बार-बार अपनी ओर खींचा करता था। प्रतिदिन कहानियों को सुनता, डरता और अगले दिन फिर सुनता।

सेवा नियोजन एवं कार्य :—

बेरोजगारी की संक्रामक बीमारी के इस युग में सचमुच मैंने स्वयं को उस समय अत्यन्त सौभाग्यशाली अनुभव किया, जब स्नातकोत्तर परीक्षा के ठीक आठ मास के भीतर ही फरवरी 1979 में वन विभाग से साक्षात्कार में उपस्थित होने के लिये मुझे पत्र मिला। साक्षात्कार में उपस्थित होने तक मुझे ज्ञात न था कि मुझे नियुक्ति के बाद क्या कार्य करना होगा। उस समय हमारे जिला (मुरैना) में वन विभाग द्वारा एक अनोखी परियोजना शुरू की गई थी। मुझे बस इतना ज्ञात था कि इस परियोजना के जरिये चम्बल नदी में घड़ियाल, मगरों की संख्या में वृद्धि की जावेगी।

नियुक्ति के पश्चात् पहली बार मुझे ज्ञात हुआ कि मुझे ही वह कार्य करना है जिसे करने की कल्पना तक मैंने अपने जीवन में कभी न की थी। कानों से सुनी बचपन की कहानियों में से एक मुझे अब अपनी आँखों से देखना था, पढ़ना था। चम्बल में घड़ियाल मगर के जीवन एवं चर्या का अध्ययन मेरा व्यवसाय निर्धारित किया गया था।

कहानियों के बादशाह घड़ियाल से मिलने के उद्देश्य से सर्व प्रथम मार्च 1979 के अन्तिम सप्ताह में चम्बल नदी के पुरैनी घाट पर जा पहुँचा। इधर उधर तलाश में भटकते हुये पूरा दिन व्यतीत हो गया, किन्तु भेंट न हो सकी और इस प्रकार उस दिन भगवान की खोज में असफल भवत की तरह मुझे निराश ही अपने मुख्य आवास पर लौट आना पड़ा। एक सप्ताह बाद फिर उसी घाट पर जा पहुँचा, इस बार मेरी यात्रा सार्थक रही। मैंने जीवन में प्रथम बार घड़ियाल को अपनी आँखों से देखा। चम्बल नदी में धोलपुर के पास बने पुल के नीचे से यमुना तक के पूरे चम्बल नदी में पुरैनी घाट घड़ियालों के लिये आज भी सर्वश्रेष्ठ स्थान है। “मगर आदमी को खा जाता है” बचपन की कहानियों का सुसुप्त संस्कार घड़ियाल को देखने से ही आज फिर जाग गया। सोचा कैसे नौकरी कर सकूंगा। विचित्र सी मनःस्थिति लेकर चल पड़ा, सोच रहा था कि प्रत्येक मास प्राप्त होने वाले चन्द सिक्कों के लिये क्या मौत से खेलना मेरे लिये उचित होगा। मुख्य आवास पर जाकर अपने शंकाकूल मन की दुविधा को मैंने विशेषज्ञों तथा अधिकारियों के सामने निःसंकोच रख दिया। अधिकारियों ने हंसते हुये कहा “भाई ऋषीकेश जी घड़ियाल आदम खोर नहीं होता, किसी विशिष्ट परिस्थिति में वह आक्रमण अवश्य कर सकता है। किन्तु वह आदमी को खाता कभी नहीं है। सुप्तावस्था तक पहुँची हुई इस दुर्लभ प्रजाति की रक्षा करना हम सभी का कर्तव्य है। अतः निर्भी-

कता के साथ आप अपना कर्तव्य पूरा करें। अधिकारियों के वचनों से आश्चस्त होकर मैं अगले दिन से पूरी लगन के साथ घड़ियाल प्रोजेक्ट पर कार्य करने में जुट गया। चम्बल के किनारे पैदल चल-चल कर मार्च 1980 तक मैंने इस दृष्टि से चम्बल का सर्वे किया, और इस सर्वे के दौरान मुझे जीवों की कई प्रकार की जलीय प्रजातियाँ देखने को मिलीं। इनमें मगर घड़ियाल के अतिरिक्त सोंस (डॉल्फिन) जलविलाव तथा विभिन्न प्रकार के चम्बल पक्षी प्रमुख रूप से यहाँ उल्लेखनीय हैं। चम्बल जलीय जीवों के लिये एक अत्यन्त सुन्दर, प्राकृतिक आवास क्षेत्र है। महीनों तक चम्बल के किनारे साधनारत रहकर मैं जलीय जीवों का विशेष कर घड़ियालों के बैठने के स्थानों, धूप सेकने का समय व अन्य क्रिया कलापों का अध्ययन करने में जुटा रहा।

घड़ियाल पुनर्वास केन्द्र :-

सन् 1979-80 में वरिष्ठ अधिकारियों के प्रयत्नों से आगरा बम्बई राष्ट्रीय मार्ग के समीप मुरैना से 6 किलोमीटर उत्तर में स्थित “देवरी” में घड़ियाल पुनर्वास केन्द्र की स्थापना हुई तथा उसी अवधि से (1978) उत्तर प्रदेश, मध्य प्रदेश एवं राजस्थान के समन्वित प्रयासों से चम्बल घड़ियाल अभ्यारण्य भी कार्यान्वित है। म० प्र० में स्थित राष्ट्रीय चम्बल अभ्यारण्य का क्षेत्रफल 400 वर्ग किलोमीटर है। इस योजना के अन्तर्गत घड़ियालों के सम्बर्धन के लिये देवरी में पानी के कुण्ड बनाये गये हैं। और उनमें कृत्रिम प्रजनित घड़ियाल शावकों को पाला जा रहा है।

केन्द्र की स्थापना का उद्देश्य :-

घड़ियाल जिसका वैज्ञानिक नाम “गैविएलिस गॅजेटिवस” है विश्व की अकेली ऐसी प्रजाति है जो भारत में केवल गंगा से मिलने वाली कई नदियों तथा ब्रह्मपुत्र व महानदी में ही पाई जाती है। सन् 1970 तक यह प्रजाति लुप्त होने तक की सीमा पर जा पहुँची। भारत सरकार के अनुरोध पर संयुक्त राष्ट्र संघ द्वारा भेजे गये विशेषज्ञ डा० बस्टर्ड ने सन् 1974 में चम्बल नदी का सर्वेक्षण करते हुये पाया कि घड़ियालों की संख्या चम्बल नदी में 60-70 के आस-पास हो गेष बची है। लुप्त प्रजाति को बचाने के लिये भारत सरकार ने सन् 1975 से योजनायें कार्यान्वित कीं। घड़ियालों की संख्या में निरन्तर कमी होते जाने के पीछे कुछ प्रमुख कारण खोजे गये वे निम्न हैं :-

- 1- कीमती चमड़े के लालच में इनका शिकार किया जाना।
- 2- इसके प्राकृतिक आवास क्षेत्रों का विनाश।
- 3- नाइलोन जाल द्वारा मछली का शिकार।
- 4- आदिम जाति व वन्य प्राणियों द्वारा इनके अण्डों को भोजन के लिये ले जाना (प्रडेशन)।
- 5- शिकारियों के प्रति दण्ड व्यवस्था में लागू करने में कमजोरी।

चम्बल नदी में घड़ियालों को बचाने के लिये ही भारत के दूसरे मगर संरक्षण केन्द्रों जैसे देवरी केन्द्र की स्थापना भी निम्न उद्देश्यों को लेकर हुई :-

- 1- प्रकृति का संतुलन बनाये रखने के लिये सभी जीवधारियों की तरह घड़ियाल का होना आवश्यक है।
- 2- लुप्ता अवस्था तक पहुँची घड़ियाल प्रजाति का संरक्षण।
- 3- देवरी में पर्यटन केन्द्र का विकास करना एवं वैज्ञानिक अनुसंधान के लिये चम्बल अभ्यारण्य का विकास करना।

4- संरक्षण प्रदाय पश्चात् भविष्य में घड़ियाल के चमड़े के निर्यात से विदेशी मुद्रा अर्जित करना।
 देवरी घड़ियाल परियोजना के अन्तर्गत घड़ियालों को पाला जाता है, उनका विकास किया जाता है और उनके विकसित होने पर उन्हें चम्बल में छोड़ दिया जाता है। केन्द्र के अधिकारी न केवल घड़ियालों को पालते हैं, अपितु विकसित होने पर चम्बल में छोड़े हुये घड़ियालों पर सतत निगरानी करते हैं, ओर उनकी सुरक्षा का भी प्रयत्न करते हैं। केन्द्र एवं केन्द्र में कार्यरत अधिकारियों के सतत प्रयास का ही यह परिणाम है कि आज की स्थिति में चम्बल नदी में निकटतम आकलन के अनुसार घड़ियालों की संख्या 1000 के आस-पास पहुँच चुकी है जो कि भारत की सभी नदियों से अधिक है। यह देश के लिये गौरव की बात है।

केन्द्र की कार्यपद्धति एवं कार्य :-

वर्ष 1981 में चम्बल नदी के बरोली घाट से हम लोगों के द्वारा दिनांक 24-5-81 को दो घोंसलों से 35 अण्डे एकत्रित किये गये। तब तक अण्डों में बढ़ते हुये शावक दो महीने के हो चुके थे। उस समय भारत सरकार के हैदराबाद स्थित मगर प्रजनन व प्रशिक्षण संस्था के छात्र अभ्यारण्य में अध्ययनरत थे उन्हीं के सहायक निर्देशक के मार्गदर्शन में एकत्रित किये हुये अण्डों को रखा गया। अण्डे का आकार 9 से० मी० लम्बाई × 6 से० मी० व्यास (औसत), वजन 190 ग्राम

इन्हें अनुकूलतम तापक्रम 30-32 डिग्री सेन्टीग्रेड पर रखा गया। दिनांक 2-6-81 को अण्डों से बच्चों की आवाज सुनी गई। और दूसरे ही दिन सुबह 25 अण्डों से बच्चे निकाले गये (वैसे तो ताजे अण्डों में से करीब 13 सप्ताह के बाद ही बच्चे निकलते हैं) उन बच्चों को पोटेशियम परमैंगनेट के घोल व सादे पानी से नहलाया गया। और शाम 6 बजे "क्वारेन्टाइन" कुण्ड में छोड़ा गया। 5 दिन बाद जब उन घड़ियाल शावकों का माप लिया गया तो वे 35-39 से० मी० (14-15 इंच) के ही थे।

वर्तमान में देवरी में 1981 के 18 घड़ियाल स्वस्थ रूप से पाले जा रहे हैं। वर्ष 1982 में चम्बल नदी से 35 अण्डे एकत्रित कर उपरोक्तानुसार प्रजनित किया गया जिनमें 29 बच्चे स्वस्थ रूप से हैं। इस प्रकार केन्द्र पर कुल 47 घड़ियाल शावक परियोजना अधिकारी के निर्देशन में पाले जा रहे हैं। वर्ष 1983 में राष्ट्रीय चम्बल अभ्यारण्य योजना के अन्तर्गत भारत सरकार के मगर अनुसंधान केन्द्र द्वारा घड़ियाल पर ट्रान्समीटर लगाकर इनकी कार्यपद्धति का अध्ययन किया जा रहा है। द्वितीय चरण में भोपाल विश्वविद्यालय के शोध छात्र द्वारा चम्बल में कछुये की विभिन्न प्रजातियों का भी अध्ययन किया जा रहा है व कछुये के अण्डों को एकत्रित कर देवरी केन्द्र पर कृत्रिम प्रजनन के लिये रखा गया है। राष्ट्रीय चम्बल अभ्यारण्य योजना के शोध विभाग द्वारा घड़ियाल नेस्टिंग इकाइयों की व अण्डों की बायो कैमिस्ट्री करने का प्रस्ताव है।

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एक बड़ी ही दिलचस्प बात कही जाती है—जंगल में घनेरी सियाह अयालों की ओढ़े, कभी चार पैरों पर तो कभी दो टांगों पर बड़े लटके मटके के साथ चलने विचरने वाले भालू (स्लाथ बियर) महाशय के बारे में—बात यह कही जाती है कि ये हज़रत भालू स्त्रियों से प्यार करते हैं, यानि स्त्रियों के सान्निध्य का ये शौक रखते हैं। इसी तरह की एक और धारणा प्रचलित है कि भालू राह में जख्मी हुए अपने साथी को छोड़ कर चला नहीं जाता वरन् उसे उठा कर सुरक्षित स्थान पर पहुंचाता है। उन तमाम जंगलों में जहाँ मैं गया और जहाँ भालू (स्लाथ बियर) पाया जाता है यह दोनों अवधारणाएं वहाँ रहने वाले आदिवासियों से सुनी और पाया कि उनका इसमें दृढ़ विश्वास है। यही नहीं यह बातें मैंने कई पुराने जाने माने शिकारियों के मुँह से भी सुनी।

दोनों ही बातें वास्तविकता से कोसों दूर हैं। मगर ये धारणाएं आखिर बनी क्योंकर? इस प्रश्न पर जब गौर करता हूँ तब इस प्राणी (भालू) की सियाह घनेरी अयालों का वह भारी भरकम लबादा मुझे किसी जादूगर की नकाब सा जान पड़ता है, जिसका भीतरी राज साधारण दृष्टि की पहुंच के परे है। विश्लेषणात्मक दृष्टि से देखने पर ये दोनों किंवदंतियां मात्र भ्रांति या दृष्टि भेद सिद्ध होती हैं। इसके लिये भालू की शरीर रचना के साथ-साथ उसकी प्रकृति का अध्ययन विश्लेषण जरूरी है। भालू के स्वभाव की तीन बड़ी कमजोरियाँ हैं। प्रथम यह कि इसकी दृष्टि तीक्ष्ण नहीं होती, बड़ी ही अल्प दृष्टि का यह प्राणी है, साथ ही इसकी श्रवण शक्ति भी क्षीण सी होती है, तीसरी बड़ी बात इसका भयंकर अघोड़ीपन है, अर्थात् जब सोता है तान कर सोता है। और इन बातों के उपरान्त है उसका यह सियाह लबादा जिसके नीचे लुप्त हो जाती है उसके शरीर की प्रत्येक हरकत और प्रतिक्रिया।

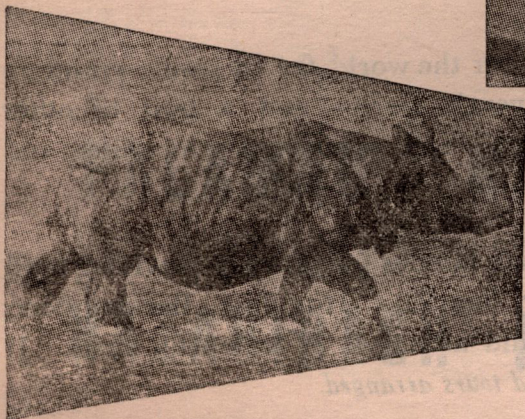
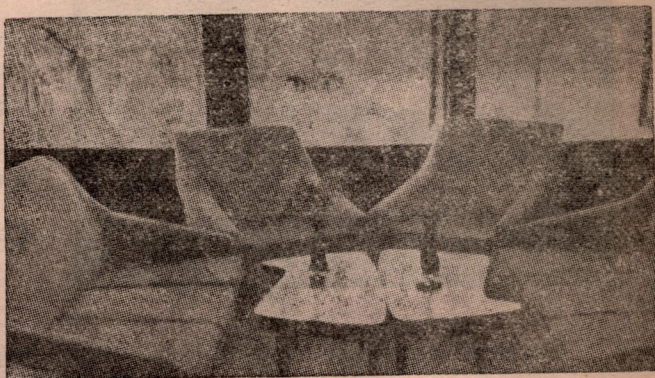
अब देखिये कि उस क्षीण श्रवण शक्ति के साथ गहरी निद्रा की स्थिति में जब वह जंगल के किसी कोने में सोया पड़ा होता है, तब अपने आस-पास में किसी की उपस्थिति का आभास उसे तभी हो पाता है जब वह व्यक्ति उसके बहुत निकट पहुंच चुका होता है। जंगल में चारा काटने और सूखी लकड़ियाँ बोनने तोड़ने का काम ज्यादातर स्त्रियाँ करती हैं। ये स्त्रियाँ अपने काम में तल्लीन भालू की उपस्थिति से बेखबर जब उसके बहुत करीब पहुंच जाती हैं, तब वह बड़बड़ा कर उठ खड़ा होता है, आम तार से दो पैरों पर - यहाँ फिर एक बात ध्यान में रखनी होगी कि जंगल के लगभग तमाम बड़े जानवरों का आम स्वभाव यह होता है कि जब भी उनका किसी मनुष्य से सावका पड़ जाता है, तब मनुष्य चूँकि उसके सम्मुख दो पैरों पर लम्बवत् खड़ा होता है और उसके मर्म अंग चार पैरों पर खड़े उस पशु की पहुंच से दूर होते हैं। अतः वह कोशिश यही करता है कि लम्बवत् खड़े उस प्राणी (दुश्मन) को पहले जमीन पर पटक दे फिर उसे दबोचे। इसी आधार पर उस स्त्री को जो अकस्मात् भालू की जद में आ गई है और उसकी बराबरी में भालू भी दो पैरों पर खड़ा है। अब

भालू अपने सम्मुख खड़ी उस स्त्री को नीचे गिराने की चेष्टा में अपने अगले दो पंजे आगे बढ़ायेगा तब ऐसा जान पड़ेगा मानो वह उस स्त्री का आलिंगन करना चाहता है। ऐसे में सम्मुख खड़े मनुष्य को नीचे गिराने में जब वह असफल रहता है तब बड़े बड़े नाखूनों वाले उसके पंजे सम्मुख खड़े मनुष्य या स्त्री के मुँह को नोचते हुए उसकी छाती पर से नीचे फिसल जाते हैं। ऐसे हादिसे चूँकि ज्यादातर औरतों के साथ होते हैं जो जंगल में सूखी लकड़ी बीनने और चारा काटने को जाती हैं अतः इस प्रकार की घटना को देखने वाला तीसरा व्यक्ति जो उस आकस्मिक घटना से घबराया सहमा भी होता है, उसे वह भालू जिसकी चाल ढाल में तेष नहीं होता है उस स्त्री को अपनी बांहों में भरने की चेष्टा करता सा जान पड़े यह बात आश्चर्यजनक नहीं। क्योंकि घनेरे वालों से ढके उस थुलथुल शरीर की असल प्रतिक्रिया को नंगी आँखों से नहीं देखा जा सकता, न तो उसकी मांसपेशियों का तनाव जाहिर होता है न आँखों के बदलते तेवर का कहीं पता होता है। इस विचित्र शरीर रचना और ढीले ढाले स्वभाव के कारण इस प्राणी के भावों को देखा समझा नहीं जा सकता। शायद इसी दृष्टि-भेद के कारण लोगों ने उसके रोष को प्रेमालाप समझ लिया है और यह अवधारणा कायम कर दी है कि भालू स्त्री सान्निध्य पसंद करता है।

ठीक इसी प्रकार से जंगल में विचर रहे दो या अधिक भालूओं में से एक को यदि गोली लगाई जाय, तब चूँकि इस प्राणी में इन्द्रिय ज्ञान की बहुत कमी होती है जिससे वह स्थिति का सही अन्दाजा नहीं लगा पाता और यह समझ बैठता है कि साथ चल रहे उसके अपने साथी ने ही उससे छेड़ धाड़ की है। नतीजा यह होता है कि बिलबिला कर वह अपने ही साथी पर टूट पड़ता है और उससे गुत्थम-गुत्था हो जाता है। यही नहीं ऐसे मौके पर वह चीखता चिल्लाता भी खूब है और चीख-चीख कर जंगल सर पर उठा देता है, मानों शिकवा कर रहा है उसका साथी उसके साथ दगा कर गया है। यह चीख पुकार और गुत्थम-गुत्था जब दूर खड़ा शिकारी देख रहा होता है जिसे यह मालूम है कि इनमें से एक भालू उसकी गोली का निशाना बना है तो उसको ऐसा आभास होता है मानों दूसरा भालू अपने घायल साथी की मदद करने के लिये संघर्षशील है और चेष्टा कर रहा है कि अपने घायल साथी को अपनी बांहों में उठा ले जाय। इस मौके पर भी वही सियाह लबादा असलियत को छुपाता है और उस थुलथुल शरीर की भावहीन अभिव्यक्ति कोरी गुत्थम-गुत्था और हड़बडाहट देखने वाले की नजर को धोखा देती है।

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